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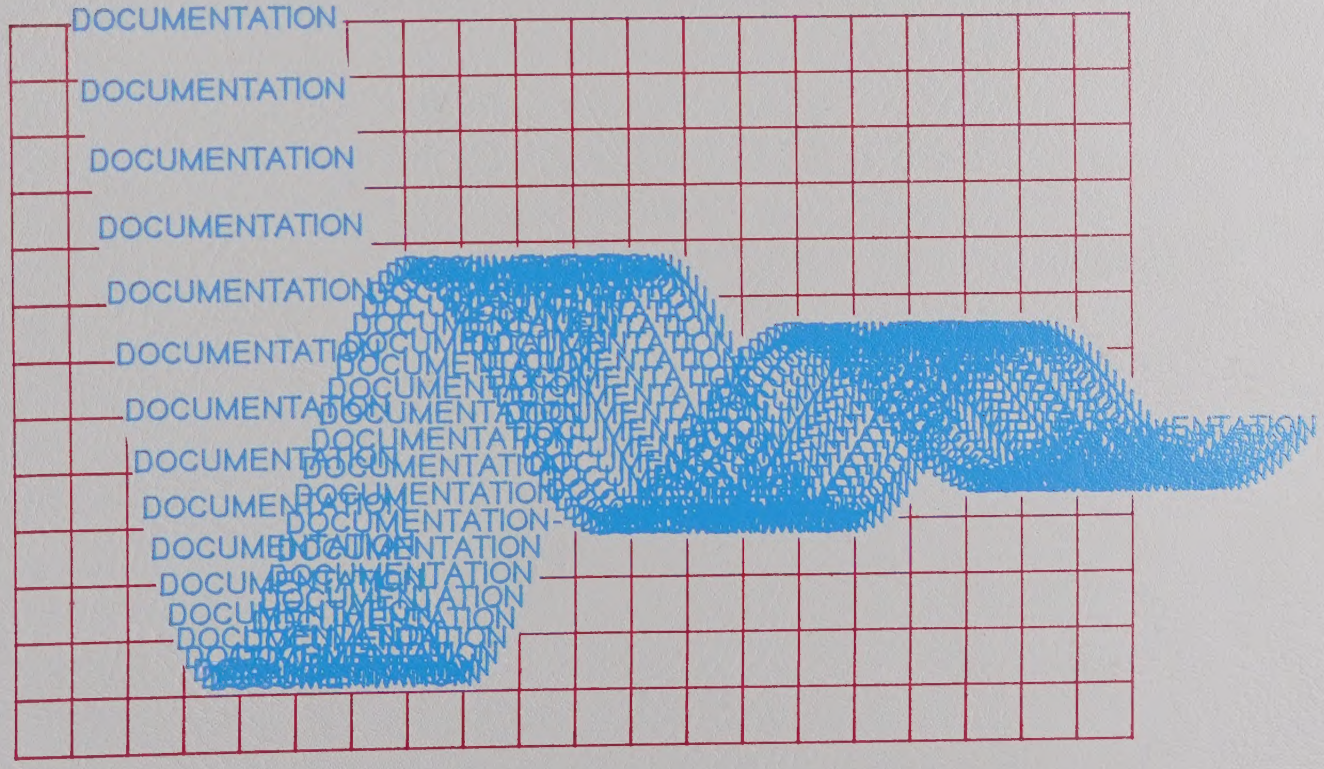

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Test and Measurement
Division

Operating Manual

3GPP WCDMA Base Station Test

Application Firmware Module FSIQK72

1126.4746.02

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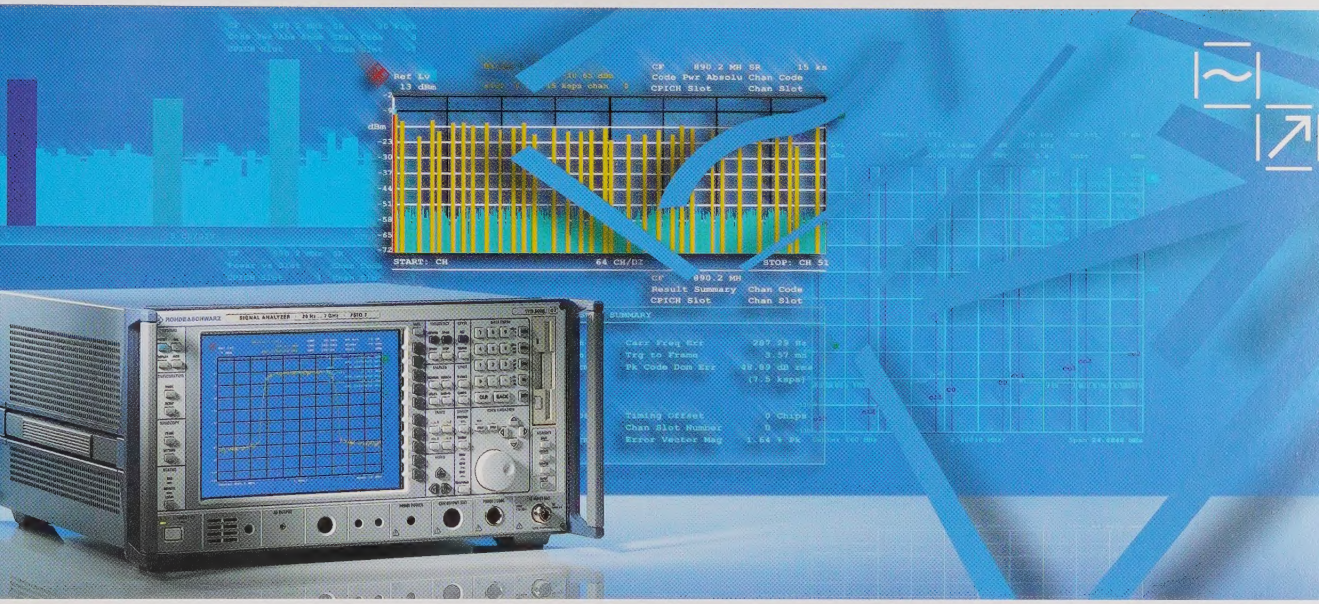

WCDMA/3GPP Application Firmware FSIQ-K72/-K73

Transmitter measurements on 3GPP equipment with Signal Analyzer FSIQ

Adds further measurement functions according to the 3GPP specifications for the FDD mode to the FSIQ analyzer family.

The K72 option provides the functionality and parameters needed for base station testing.

The K73 option provides the user equipment (UE) functionality and parameters.

- Code domain power (code domain analyzer)
- Code domain power versus time
- Error vector magnitude (EVM)
- Peak code domain error
- Timing offset
- Occupied bandwidth (OBW)
- Adjacent-channel leakage ratio (ACLR)
- Spectrum emission mask
- Complementary cumulative distribution function (CCDF)

Featuring wide dynamic range for adjacent-channel power and high-precision RMS power measurements, the FSIQ is an ideal tool for WCDMA transmitter measurements in development and production.

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Application Firmwares FSIQ-K72/-K73 enhance the wide range of applications of the Signal Analyzer FSIQ to include code domain power and modulation measurements on 3GPP/FDD signals.

All transmitter measurements required according to 3GPP Specification TS 25.141 V3.5.0 can thus be performed by a single instrument.

Measurement	FSIQ	FSIQ with FSIQ-K72	FSIQ with FSIQ-K73
Maximum output power	x		
CPICH power accuracy		x	N/A
Frequency error	x[2)]	x	x[3)]
Power control dynamic range		x	
Total power dynamic range		x	N/A
Occupied bandwidth	x		
Spectrum emission mask	x[1)]	x	x
ACLR	x		
Spurious emissions	x[1)]		
Error vector magnitude	x[2)]	x	x
Peak code domain error		x	x

1) These measurements can be performed with basic functions of the FSIQ, without any 3GPP-specific setting functions.
2) These measurements can be performed on a 3.84 MHz QPSK signal (e.g. only P-CCPCH without SCH or one DPCCH and one DPDCH).
3) UE frequency relative to frequency received from BS.

Code domain power measurements

The main application of FSIQ-K72/-K73 is the determination of the power in the individual code channels referred to as code domain power measurement. The power ratios between the individual channels for instance can be checked for compliance with the nominal values.

Moreover, this measurement is a very efficient tool for detecting impairments such as clipping or intermodulation effects that are not obvious from the spectrum alone.

The power of the different codes is shown versus the code number. The width of the displayed bargraph intuitively provides information about the occupied code domain and the spreading factor.

To investigate power control, the power characteristic in a code channel can be displayed versus all slots of a frame (10 ms).

Measurement of modulation quality: peak code domain error and EVM

Two different measurements are stipulated in the 3GPP Specifications TS 25.141 and TS 34.121 for determining the modulation quality:

- EVM (error vector magnitude)
- Peak code domain error

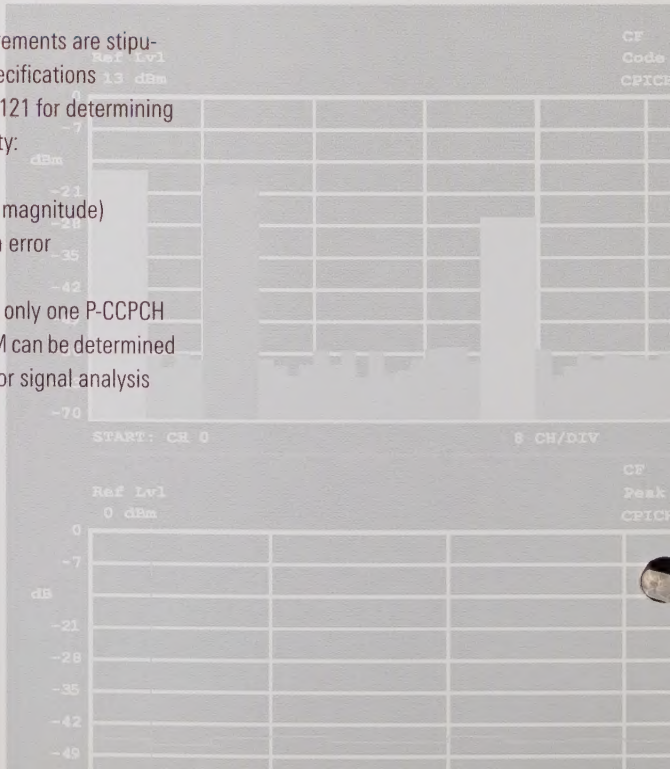
For a signal with e.g. only one P-CCPCH without SCH, the EVM can be determined with the normal vector signal analysis function of the FSIQ.

The code domain power measurement offers an in-depth analysis for a WCDMA signal with several active channels. The modulation accuracy measurement returns a modulation error value for the total signal, whereas the symbol EVM function yields the individual vector errors of the active channels.

To obtain the peak code domain error (PCDE), the vector error between the measured signal and the ideal reference signal is determined and projected to the codes of a specific spreading factor. With FSIQ-K72/-K73, the spreading factor for the PCDE measurement can be selected by the user.

Automatic detection of active channels and their data rate

The scrambling code, which is user-selectable on the FSIQ, must be known for the code domain power measurement. 3GPP/FDD signals may use different spreading factors and data rates in the various channels. The data rates are automatically detected by FSIQ-K72/-K73 and need not be known beforehand.



Spectrum measurements over wide dynamic range

The FSIQ is a powerful analyzer for WCDMA signals even without Application Firmware FSIQ-K72/-K73 and of course retains these functions when fitted with FSIQ-K72/-K73.

An RMS detector integrated as standard allows precise transmitter power measurements irrespective of the waveform. The reproducibility of the measurement can easily be adapted to the test requirements via the measurement time.

Given the settings defined for channel power measurements in line with the 3GPP standard and a measurement time of 200 ms, the reproducibility (1 σ value) is <0.1 dB.

Thanks to its extremely wide dynamic range the FSIQ is the ideal analyzer for out-of-band emissions that have to be detected for instance by means of adjacent-channel power measurements.

With a dynamic range of more than 75 dB in the adjacent channel and more than 82 dB in the alternate channel the FSIQ exceeds by far the values prescribed by the specification.

Measurements cannot only be performed on systems but also on individual components such as amplifiers which have to meet more stringent requirements. To achieve the maximum dynamic range, the optimum mixer level can be set very precisely using the optional 1 dB Attenuator FSE-B13.

Spectrum emission mask
To perform the spectrum emission mask measurement in line with 3GPP Specifications TS 25.141 and TS 34.121, the FSIQ provides a measurement function that gives a pass/fail result.

FSIQ-K72 detects the output power of the BS and applies the correct limits. FSIQ-K73 includes the limits for the UE. The limits are not dependent on the output power. Both K72 and K73 enable the user to define new limits.

Complementary cumulative distribution function (CCDF)
Additional information about the time domain statistics of the signal can be obtained by using the CCDF function of FSIQ-K72/-K73.

This measurement can for instance provide information about the correlation between different codes and the influence of multiple code transmission.

To simplify operation, FSIQ-K72/-K73 provide the main spectrum measurements in the main menu:

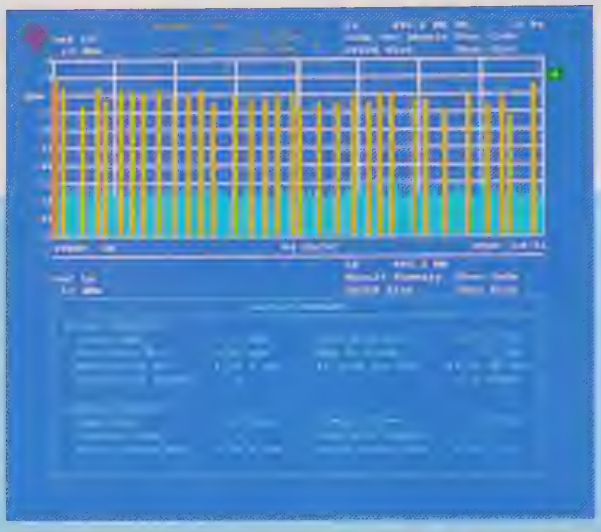
- Power
- ACLR
- Occupied bandwidth
- Spectrum
- Spectrum emission mask
- Time domain
- CCDF

Remote control

All measurements can be remote-controlled as well as results and demodulated data be transferred via the IEEE bus. The settings already defined in the application firmware make the handling of the FSIQ extremely easy so that it is ideal for use in production environments.

Other standards

Application Software Packages FSE-K11 (GSM transmitter measurements), FSIQ-K71 (code domain power measurements for IS-95) and the basic vector signal analysis functions of FSIQ itself make FSIQ a universal and multistandard-capable platform for base station transmitter measurements.



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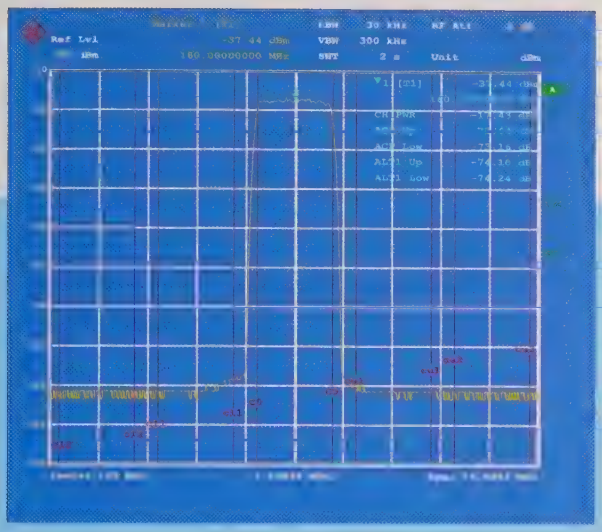
Applications and Examples

Code domain power measurement on a signal with 32 active channels (1)
Active and inactive channels are marked in different colours. Inactive channels (noise, interference) are displayed with the highest spreading factor. The table shows in addition the main parameters of the total signal at a glance, e.g. total power, frequency error and error of chip rate, as well as the parameters of the marked code channel, such as timing offset and code power.

Measurement of code domain power versus time (2)
The code power can additionally be displayed versus the 15 slots of a frame to determine the accuracy of power control.

Peak code domain error measurement (3)
The peak code domain error is projected to the codes of the highest spreading factors. The maximum value of all codes per slot is displayed.

Error vector measurement (4)
A signal comprising a large number of active channels can no longer be analyzed with the usual vector signal analyzer functions. FSIQ-K72 therefore provides the modulation accuracy measurement function that allows the EVM of a total signal to be measured for multichannel signals too. This measurement is closer to reality than the EVM measurement with one active channel only (P-CCPCH).



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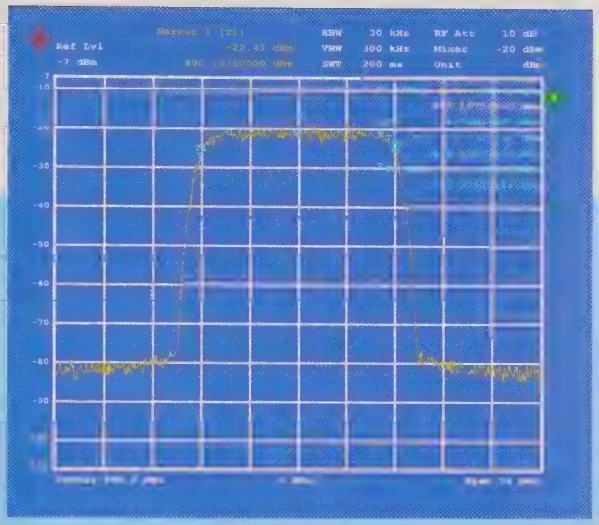

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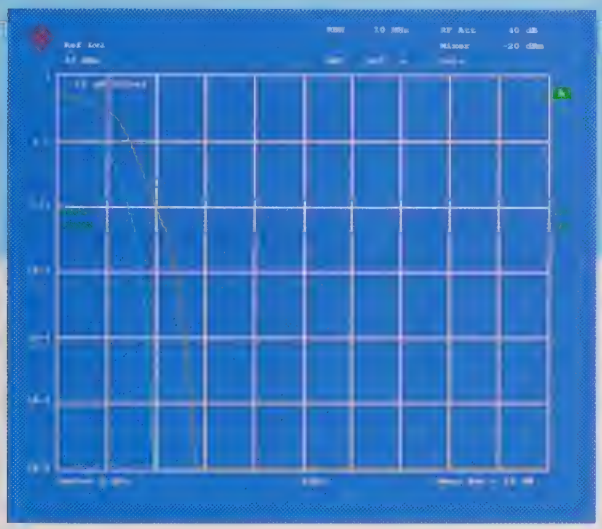

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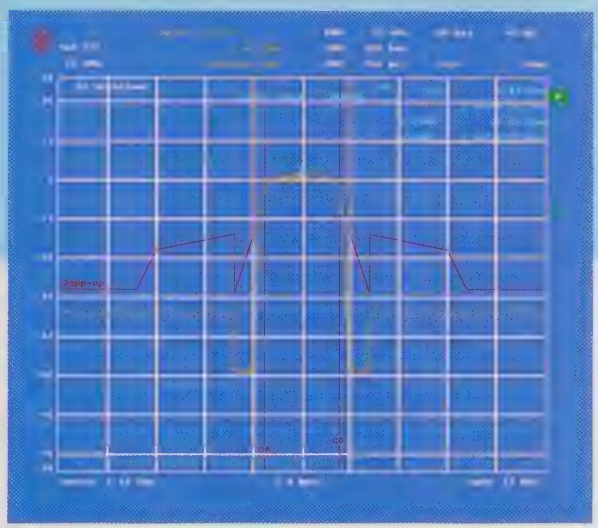

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ACLR measurement with maximum dynamic range and highly reproducible RMS power measurement (5)
The requirements for measurements on components are usually more stringent than the limit values prescribed by the specification. With its low noise figure of 18 dB and third-order intercept point of 20 dBm (FSIQ7), the FSIQ features an adjacent-channel leakage ratio of 75 dB.

Measurement of occupied bandwidth (6)
The occupied bandwidth is measured to determine the bandwidth in which 99% of the signal power is transmitted. The limit value according to 3GPP is 5 MHz.

Spectrum emission mask measurement (7)
The measurement is defined with a 30 kHz measurement bandwidth from 2.5 MHz to 3.5 MHz offset from carrier. From 3.5 MHz to 12.5 MHz the measurement is performed in a 1 MHz measurement bandwidth. The limit values are according to 3GPP Specifications TS 34.121.

Measurement of the complementary cumulative distribution function (8)
The graphs display the CCDF of two signals, i.e. one single code signal and one signal comprising two codes. Both signals are uplink signals.

Specifications

The specifications below apply to the FSIQ3, FSIQ7, FSIQ26 and FSIQ40 fitted with the options FSIQ-B70 and FSIQ-K72/-K73. They are based on the data sheet specifications of the Signal Analyzer FSIQ and have not been checked separately. Specifications are guaranteed under the following conditions: 15 minutes warmup time at ambient temperature, specified environmental conditions met, calibration cycle adhered to and internal calibration performed. Data with tolerances are measurement uncertainties with a confidence level of 95 %. The specified level measurement errors do not take into account systematic errors due to reduced S/N ratio.

FSIQ-K72

Measurement		Test specifications and permissible measurement uncertainty to 3GPP TS 25.141 V3.5.0
Code domain power (applies to code domain power and code domain power vs slot)		
Total signal power, measurement uncertainty	<0.6 dB	6.2.1 <0.7 dB
CPICH power, measurement uncertainty	<0.7 dB	6.2.2 <0.8 dB
Code power, measurement uncertainty		
Absolute	<0.7 dB	
Relative	<0.1 dB	<0.1 dB
Frequency error		6.3, 6.7.1
Measurement range	<1 kHz	<12 Hz
Uncertainty (S/N >40 dB)	<1.5 Hz + error of reference frequency	
Modulation accuracy (composite EVM)		
Measurement range	1.5% to 25%	12.5% to 25%
Inherent EVM	<1.5%	
Measurement uncertainty	<0.5%	<2.5%
Peak code domain error		6.7.3
Measurement range	0 dB to –60 dB	–33 dB
Inherent PCDE	–60 dB	
Measurement uncertainty	<1 dB (0 dB to –40 dB)	<1 dB
Output power		6.2.1
Measurement uncertainty, absolute	<0.6 dB	<0.7 dB
Measurement uncertainty, relative	<0.2 dB	
Occupied bandwidth (99%)		6.5.1
Measurement uncertainty	<85 kHz	<100 kHz
ACLR (adjacent channel leakage ratio) (3.84 MHz BW)		6.5.2.2
5 MHz offset		45 dB
Dynamic range	75 dB	
Measurement uncertainty	<0.5 dB (ACLR <60 dB)	<0.8 dB
10 MHz offset		50 dB
Dynamic range	82 dB	
Measurement uncertainty	<0.5 dB (ACLR <60 dB)	<0.8 dB
Spurious emissions		
Level uncertainty		
<2.2 GHz	<1 dB	
2.2 GHz to 4 GHz	<1.5 dB	
>4 GHz	<2.5 dB	
Spectrum emission mask	<1.5 dB	

FSIQ-K73

Measurement		Test specifications and permissible measurement uncertainty to 3GPP TS 34.121 V3.4.0
Code domain power (applies to code domain power and code domain power vs slot)		
Maximum output power	<0.6 dB	5.2 <0.7 dB
Minimum output power		5.4.3 <1 dB
Code power, measurement uncertainty		
Absolute	<0.7 dB	
Relative	<0.1 dB	<0.1 dB over 1.5 dB range
	<0.3 dB	<0.3 dB over 12 dB range
Frequency error		5.3
Measurement range	<1 kHz	<10 Hz
Uncertainty (S/N >40 dB)	<1.5 Hz + error of reference frequency	
Modulation accuracy (composite EVM)		
Measurement range	1.5% to 25%	12.5% to 25%
Inherent EVM	<1.5%	
Measurement uncertainty	<0.5%	<2.5%
Peak code domain error		5.1.3
Measurement range	0 dB to –60 dB	–15 dB
Inherent PCDE	–60 dB	
Measurement uncertainty	<1 dB (0 dB to –40 dB)	<1 dB

Output power		5.2
Measurement uncertainty, absolute	<0.6 dB	<0.7 dB
Measurement uncertainty, relative	<0.2 dB	
Occupied bandwidth (99%)		5.8
Measurement uncertainty	<85 kHz	<100 kHz
ACLR (adjacent channel leakage ratio) (3.84 MHz BW)		5.10
5 MHz offset		32.2 dB
Dynamic range	75 dB	
Measurement uncertainty	<0.5 dB (ACLR <60 dB)	<0.8 dB
10 MHz offset		42.2 dB
Dynamic range	82 dB	
Measurement uncertainty	<0.5 dB (ACLR <60 dB)	<0.8 dB
Spurious emissions		
Level uncertainty		
<2.2 GHz	<1 dB	<1.5 dB
2.2 GHz to 4 GHz	<1.5 dB	<2 dB
>4 GHz	<2.5 dB	<4 dB
Spectrum emission mask	<1.5 dB	

Ordering information

Application Firmwares FSIQ-K72/-K73 can be integrated into any member of the FSIQ family. Option FSIQ-B70, memory extension and DSP, is a prerequisite for operating the application firmware. Additional modifications may become necessary if FSIQ-B70 is retrofitted.

Designation	Type	Order No.
Application Firmware 3GPP BTS Code Domain Power Measurements for FSIQ	FSIQ-K72	1126.4746.02
Application Firmware 3GPP UE Code Domain Power Measurements for FSIQ	FSIQ-K73	1153.1009.02
DSP and IQ Memory Extension 2 x 512 k	FSIQ-B70	1119.6747.02

Recommended extras

Designation	Type	Order No.
1 dB Attenuator for FSE/FSIQ	FSE-B13	1126.4746.02
High-Power Attenuator 20 dB, 50 W, 0 GHz to 6 GHz	RDL50	1035.1700.52

Certified Environmental System ISO 14001 REG. NO 1954

Certified Quality System ISO 9001 DQS REG. NO 1954

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Safety Instructions

This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

Safety-related symbols used on equipment and documentation from R&S:

Observe operating instructions

Weight indication for units >18 kg

PE terminal

Ground terminal

Danger! Shock hazard

Warning! Hot surfaces

Ground

Attention! Electrostatic sensitive devices require special care

1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:

   IP degree of protection 2X, pollution severity 2 overvoltage category 2, only for indoor use, altitude max. 2000 m.

   The unit may be operated only from supply networks fused with max. 16 A.

   Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.

2. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures should be taken to avoid any hazards.

   (using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).

3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made. Installation and cabling of the unit to be performed only by qualified technical personnel.

4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.

5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.

   If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.

6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.

7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.

   Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.

8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.

   If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.

9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

   Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.

   Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.

   Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.

   (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

continued overleaf

10. Ensure that the connections with information technology equipment comply with IEC950 / EN60950.
11. Lithium batteries must not be exposed to high temperatures or fire.

    Keep batteries away from children.

    If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see spare part list).

    Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.

    Do not short-circuit the battery.
12. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic and mechanical protection.
13. Electrostatics via the connectors may damage the equipment. For the safe handling and operation of the equipment, appropriate measures against electrostatics should be implemented.
14. The outside of the instrument is suitably cleaned using a soft, lint-free dustcloth. Never use solvents such as thinners, acetone and similar things, as they may damage the front panel labeling or plastic parts.
15. Any additional safety instructions given in this manual are also to be observed.

Certified Quality System

ISO 9001

DQS REG. NO 1954-04

Sehr geehrter Kunde,

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Contents of Manual for Application Firmware FSIQK72

This manual contains all information on the operation of FSIQ equipped with Application Firmware FSIQK72. It includes operation via menus and the remote-control commands for the 3GPP WCDMA base station test.

The manual comprises the data sheet and 10 chapters:

The data sheet	informs on the guaranteed specifications and the firmware characteristics.
Chapter 1	describes how to enable the application firmware module.
Chapter 2	describes typical examples of measurements by means of tests.
Chapter 3	describes the measurement setup for base station tests.
Chapter 4	describes the 3GPP WCDMA test models as stipulated in standard FDD (3G TS 25.141 V3.7.0).
Chapter 5	gives a schematic overview of the WCDMA control menus.
Chapter 6	contains a detailed description of the possible base station test measurements as a reference for manual operation The chapter also presents a list of remote-control commands associated with each function.
Chapter 7	describes all remote-control commands defined for the code domain measurement. An alphabetic list of all remote-control commands and a table of softkeys with the assignment of commands are given at the end of this chapter.
Chapter 8	contains the performance test.
Chapter 9	contains an explanation of terms related to measured quantities of the code domain measurement.
Chapter 10	contains the index of this operating manual.

This manual is a supplement to the FSIQ operating manual. It includes exclusively functions of Application Firmware FSIQK72. For all other descriptions, please refer to the FSIQ operating manual.

3GPP WCDMA Base Station Test - Application Firmware FSIQK72

Signal Analyzer FSIQ equipped with Application Firmware FSIQK72 performs code domain power measurements on downlink signals according to standard 3GPP (FDD mode). The application firmware is in line with standard 3GPP (Third Generation Partnership Project) with version release 99. In addition to the code domain measurements prescribed by the standard 3GPP, the application offers measurements with predefined settings in the frequency domain, e.g. power and ACLR measurement.

The following hardware is required for using FSIQ in combination with option FSIQK72:

- Option FSIQB70 – Extended I/Q memory and DSP module
- Module I/Q Demodulator: model index 05 (Order No.: 1066.2520.05)

Notes: - *The code domain power measurements can be performed for units fitted with IQ demodulators other than model 05. However, the linearity of the FSIQK72 level values can only be guaranteed with an IQ demodulator of model 05 or higher.*

- *The model index of the I/Q Demodulator is indicated in table "Installed Components" (SYSTEM-INFO HARDWARE+OPTIONS menu)*

1 Enabling the Firmware Option

Firmware Option FSIQK72 is enabled in the *CONFIGURATION SETUP* menu by entering a keyword. The keyword is delivered with the option. If the option is factory-installed, it is already enabled.

CONFIGURATION SETUP menu:

The *OPTIONS* softkey opens a submenu where keywords for new firmware options (application firmware modules) can be entered. Available options are displayed in a table which is opened when entering the submenu.

The *ENABLE NEW OPTION* softkey activates the entry of the keyword for a firmware option.

One ore several keywords can be entered in the entry field. On entering a valid keyword, *OPTION KEY OK* is displayed on the message line and the option is entered in the *FIRMWARE OPTIONS* table.

The *FIRMWARE OPTIONS* table can be displayed in the *FIRMWARE OPTIONS* softkey in the *INFO* menu.

In case of invalid keywords, *OPTION KEY INVALID* is displayed on the message line.

2 Getting Started

The following chapter explains basic WCDMA base station tests by means of a setup with Signal Generator SMIQ. It describes how operating and measurement errors can be avoided using correct presetting.
The measurement screen is presented in chapter 6 for each measurement.

Key settings are shown as examples to avoid measurement errors. Following the correct setting, the effect of an incorrect setting is shown. The following measurements are performed:

- Measurement 1: Measuring the spectrum
- Measurement 2: Measurement of CPICH (Common Pilot Channel) in vector signal analyzer mode
  - Setting: Synchronization of reference frequencies
- Measurement 3: Measurement of relative code domain power
  - Setting: Setting the analyzer center frequency to the DUT frequency
  - Setting: Scrambling code of signal
- Measurement 4: Triggered measurement of relative code domain power
  -Setting: Trigger offset
- Measurement 5: Measurement of composite EVM
- Measurement 6: Measurement of peak code domain error

The measurements are performed using the following units and accessories:

- Signal Analyzer FSIQ with Application Firmware FSIQK72: WCDMA base station test (option FSIQB70 required)
- Vector Signal Generator SMIQ with option SMIQB43: digital standard WCDMA
  (options SMIQB20 and SMIQB11 required)
- 1 coaxial cable, 50 Ω, approx. 1 m, N connector
- 1 coaxial cable, 50 Ω, approx. 1 m, BNC connector

Conventions for displaying settings on FSIQ:

[***<KEY>***]	Press a key on the front panel, e.g. ***[SPAN]***
[<SOFTKEY>]	Press a softkey, e.g. *[MARKER -> PEAK]*
[<nn unit>]	Enter a value and terminate by entering the unit, e.g. *[12 kHz]*

Conventions for displaying settings on SMIQ:

[***<KEY>***]	Press a key on the front panel, e.g. ***[FREQ]***
<MENU>	Select a menu, parameter or a setting, e.g. *DIGITAL STD.* The menu level is marked by an indentation.
<nn unit>	Enter a value and terminate by entering the unit, e.g. *12 kHz*

Basic Settings in Code Domain Measurement Mode

In the default setting after PRESET, FSIQ is in the analyzer mode. The following default settings of the code domain measurement are activated, provided the code domain measurement mode is selected.

Table 2-1 Default settings of the code domain measurement

Parameter	Setting
Digital standard	W-CDMA 3GPP FWD
Sweep	CONTINUOUS
CDP mode	CODE CHAN AUTOSEARCH
Trigger settings	FREE RUN
Trigger offset	-266.67µs
Scrambling code	0
Threshold value	-20 dB
Symbol rate	15 ksps
Code number	0
Slot number	0
Display	Screen A: CODE PWR RELATIVE Screen B: RESULT SUMMARY

Measurement 1: Measuring the Signal Power

The measurement of the spectrum gives an overview of the WCDMA signal and the spurious emissions close to the carrier.

Test setup

➢ Connect the RF output of SMIQ to the RF input of FSIQ (coaxial cable with N connectors).

.

Settings on SMIQ:

[PRESET]
[LEVEL: *0 dBm]*
[FREQ: *2.1175 GHz]*
DIGITAL STD
WCDMA/3GPP
SET DEFAULT
SELECT BS/MS
BS 1 ON
P-CPICH STATE ON
STATE: ON

Settings on FSIQ:

[PRESET]
[CENTER: *2.1175 GHz]*
[REF: *0 dBm]*
[MODE: *3GPP BTS ANALYZER: POWER]*

Measurement on FSIQ:

The following is displayed:

- The spectrum of the WCDMA signal (CPICH only) on the trace
- The signal channel power within the 3.84 MHz channel bandwidth (in the marker info field)

Measurement 2: Measurement of CPICH in Vector Signal Analyzer Mode

When the WCDMA signal only contains one channel, the signal can be measured in the vector analyzer mode of the analyzer. Since each channel is QPSK-modulated, the total signal is QPSK-modulated also if only one channel is transmitted.
The measurement of the QPSK signal allows, for instance, to determine the frequency offset between DUT and analyzer.
This may be useful for troubleshooting, e.g. if synchronization is not possible during the code domain power measurement.

Test setup *As for measurement 1*

Settings on SMIQ: *As for measurement 1*

Settings on FSIQ: ***[PRESET]***
[CENTER: *2.1175 GHz]*
[REF: *0 dBm]*
[MODE: *VECTOR ANALYZER*
DIGITAL STANDARDS *W-CDMA 3GPP FWD]*

Measurement on FSIQ: The following is displayed:
- Screen A: Constellation diagram of signal (QPSK)
- Screen B: Numeric results of demodulation

Frequency error The frequency error display denotes the frequency offset between the DUT and the analyzer. For a high frequency offset (>1 kHz), the CDP measurements are inaccurate and a synchronization of the analyzer and the measurement signal is no longer possible. The frequency offset can be corrected by tuning the transmitter or center frequency of the analyzer. It is recommended to synchronize the analyzer and the DUT via the reference input of the analyzer.

Setting: Synchronizing the reference frequencies

The synchronization of the reference oscillators both of the DUT and analyzer strongly reduces the measured frequency error.

Test setup ➢ Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the rear panel of SMIQ (coaxial cable with BNC connectors).

Settings on SMIQ: *As for measurement 2*

Settings on FSIQ: *As for measurement 2, plus*
[SETUP: *REFERENCE EXT]*

Measurement on FSIQ: Frequency error The displayed frequency error should be < 10 Hz.

The reference frequencies of the analyzer and of the DUT should be synchronized

Measurement 3: Measurement of Relative Code Domain Power

A code domain power measurement on one of the test models (model 1 with 32 channels) is shown in the following. To demonstrate the effects the basic parameters of CDP measurements which allow an analysis of the signal are changed one after the other from values adapted to the measurement signal to non-adapted values.

Test setup

- Connect the RF output of SMIQ to the input of FSIQ
- Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference input (REF) on the rear panel of SMIQ (coaxial cable with BNC connectors).

Settings on SMIQ:

[PRESET]
[LEVEL: *0 dBm]*
[FREQ: *2.1175 GHz]*
DIGITAL STD
WCDMA 3GPP
TEST MODELS ...
TEST1_32
SELECT BS/MS
BS 1 ON
PICH STATE: OFF
STATE: ON

Settings on FSIQ:

[PRESET]
[CENTER: *2.1175 GHz]*
[REF: *10 dBm]*
[MODE: *3GPP BTS ANALYZER: CODE DOM POWER*
MEAS SETTINGS *SCRAMBLING CODE 0]*

Measurement on FSIQ: The following is displayed:

Screen A: Code domain power of signal (test model 1 with 32 channels)

Screen B: Numeric results of CDP measurement

Setting: Behaviour with Deviating Center Frequency Setting

In the following, the behaviour of the DUT and the analyzer with deviating center frequency setting is shown.

Settings on SMIQ: ➢ Tune the center frequency of the signal generator in 1 kHz steps and watch the analyzer screen:

Measurement on FSIQ:
- A CDP measurement on the analyzer is still possible with a frequency error of up to approx. 1 kHz. Up to 1 kHz, a frequency error causes no apparent difference in measurement accuracy of the code domain power measurement.
- Above a frequency error of 1 kHz, the probability of an impaired synchronization increases. With continuous measurements, at times all channels are displayed in blue with almost the same level.
- Above a frequency error of approx. 3 kHz, a CDP measurement cannot be performed. FSIQ displays all possible codes in blue with a similar level.

Settings on SMIQ: ➢ Set the signal generator center frequency again to 2.1175 GHz:
[FREQ: *2.1175 GHz]*

The analyzer center frequency should not differ from the DUT frequency by more than 1 kHz.

Setting: Behaviour with Incorrect Scrambling Code

A valid CDP measurement can only be carried out if the scrambling code set on the analyzer is identical to the one of the transmitted signal.

Test setup *SELECT BS/MS*
BS 1: ON
SCRAMBLING CODE: 0001
(the scrambling code is set to 0000 on the analyzer)

Settings on SMIQ: The CDP display shows all possible codes with approximately the same level.

Settings on FSIQ: Set scrambling code to new value:
[MODE: *3GPP BTS ANALYZER: CODE DOM POWER*
MEAS SETTINGS *SCRAMBLING CODE 1]*

Measurement on FSIQ: The CDP display again shows the test model.

The scrambling code setting of the analyzer must be identical to that of the measured signal.

Measurement 4: Triggered Measurement of Relative Code Domain Power

If the code domain power measurement is performed without external triggering, a section of approximately 20 ms of the test signal is recorded at an arbitrary moment to detect the start of a WCDMA frame in this section. Depending on the position of the frame start, the required computing time can be quite long (up to approx. 3 seconds). The computing time can be reduced by applying an external (frame) trigger.

Test setup

- Connect the RF output of SMIQ to the input of FSIQ
- Connect the reference input (EXT REF IN/OUT) on the rear panel of FSIQ to the reference input (REF) on the rear panel of SMIQ (coaxial cable with BNC connectors).
- Connect the external trigger input on the rear panel of FSIQ (EXT TRIG GATE) to the external trigger output on the rear panel of SMIQ (TRIGOUT1 of PAR DATA).

Settings on SMIQ: *As for measurement 3*

Settings on FSIQ: *As for measurement 3, plus*
[MEAS SETTINGS TRIGGER EXT]

Measurement on FSIQ: The following is displayed:
Screen A: Code domain power of signal
(test model 1 with 32 channels)
Screen B: Numeric results of CDP measurement

Trg to Frame: Offset between trigger event and start of WCDMA frame

The repetition rate of the measurement increases considerably compared to the repetition rate of a measurement without external trigger.

Setting: Trigger offset

A delay of the trigger event referred to the start of the WCDMA frame can be compensated by modifying the trigger offset.

Settings on FSIQ: ***[MODE:*** *3GPP BTS ANALYZER: CODE DOM POWER*
MEAS SETTINGS EXT TRIG OFFSET 100 µs]

Measurement on FSIQ: The parameter Trg to Frame in the numeric results table (screen B) changes:
Trg to Frame -100 µs

Note: *To enable the start of a CDP measurement at slot 0 of a WCDMA frame, the trigger offset has to be set to –266,67 µs. For a detailed description of the relation between trigger offset and CDP analysis see the following chapters*

A trigger offset compensates analog delays of the trigger event.

Measurement 5: Measurement of Composite EVM

The composite EVM measurement represents a measurement of the RMS-averaged deviation of the test signal from the ideal signal.
An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The square deviation yields the composite EVM.

Test setup

- Connect the RF output of SMIQ to the input of FSIQ
- Connect the reference input (EXT REF IN/OUT) on the rear panel of FSIQ to the reference input (REF) on the rear panel of SMIQ (coaxial cable with BNC connectors).
- Connect the external trigger input on the rear panel of FSIQ (EXT TRIG GATE) to the external trigger output on the rear panel of SMIQ (TRIGOUT1 of PAR DATA).

Settings on SMIQ:

[PRESET]
[LEVEL: 0 dBm]
[FREQ: 2.1175 GHz]
DIGITAL STD
WCDMA 3GPP
TEST MODELS ...
TEST1_32
SELECT BS/MS
BS 1 ON
PICH STATE OFF
STATE: ON

Settings on FSIQ:

[PRESET]	
[CENTER:	*2.1175 GHz]*
[REF:	*10 dBm]*
[MODE:	*3GPP BTS ANALYZER: CODE DOM POWER*
MEAS SETTINGS	*SCRAMBLING CODE 0*
	INACT CHAN THRESHOLD -20
	TRIGGER EXT
[menu change key UP]	
RESULT DISPLAY	*COMPOSITE EVM]*

Measurement on FSIQ: The following is displayed:

Screen A: Code domain power of signal (Test model 1 with 32 channels)
Screen B: Composite EVM (EVM for total signal)

Measurement 6: Measurement of Peak Code Domain Errors

The peak code domain error measurement is defined in the 3GPP specification for WCDMA signals. An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The difference of the two signals is projected onto the classes of the different spreading factors. The peak code domain error measurement is obtained by summing up the symbols of each difference signal slot.

Test setup

- Connect the RF output of SMIQ to the input of FSIQ
- Connect the reference input (EXT REF IN/OUT) on the rear panel of FSIQ to the reference input (REF) on the rear panel of SMIQ (coaxial cable with BNC connectors).
- Connect the external trigger input on the rear panel of FSIQ (EXT TRIG GATE) to the external trigger output on the rear panel of SMIQ (TRIGOUT1 of PAR DATA).

Settings on SMIQ:

[PRESET]
[LEVEL: *0 dBm]*
[FREQ: *2.1175 GHz]*
DIGITAL STD
WCDMA 3GPP
TEST MODELS ...
TEST1_32
SELECT BS/MS
BS 1 ON
PICH STATE OFF
STATE: ON

Settings on FSIQ:

[PRESET]
[CENTER: *2.1175 GHz]*
[REF: *0 dBm]*
[MODE: *3GPP BTS ANALYZER: CODE DOM POWER*
MEAS SETTINGS *SCRAMBLING CODE 0*
INACT CHAN THRESHOLD -20
TRIGGER EXT
[menu change key UP]
RESULT DISPLAY *PEAK CODE DOMAIN ERR*
SELECT PCDE SF 512]

Measurement on FSIQ:

The following is displayed:
Screen A: Code domain power of signal (test model 1 with 32 channels)
Screen B: Peak code domain error (projection of the error onto the class with spreading factor 512)

3 Setup for Base Station Tests

Caution:

Before turning the instrument on, the following conditions must be fulfilled:

- *Instrument covers are in place and all fasteners are tightened.,*
- *Fan openings are free from obstructions.*
- *Signal levels at the input connectors are all below specified maximum values. The level at the FSIQ RF input of +20 dBm with a 0 dB input attenuator must under no circumstances be exceeded.*
- *Signal outputs are correctly connected and not overloaded.*

Non-compliance with these instructions may cause damage to the instrument .

This section describes how to set up the analyzer for WCDMA base station tests. As a prerequisite for starting the test, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the operating manual for the analyzer. Furthermore, the application firmware module must be properly installed following the instructions given in chapter 1 of the present manual.

Standard Test Setup

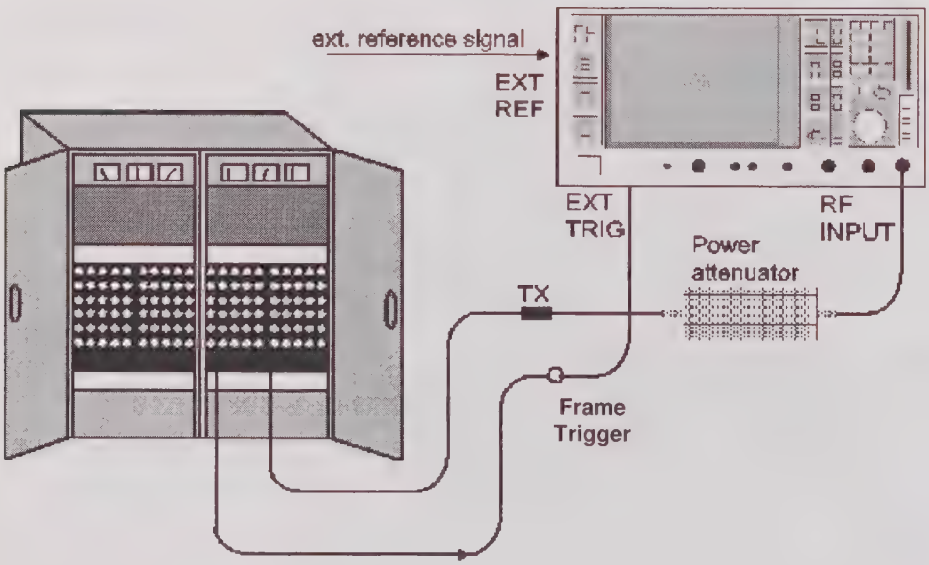


Fig. 3-1 BTS test setup

➢ Connect antenna output (or TX output) of BTS to RF input of the analyzer via a power attenuator of suitable attenuation.

The following values are recommended for the external attenuator to ensure that the RF input of the analyzer is protected and the sensitivity of the analyzer is not reduced too much.

Max. power	Recommended ext. attenuation
≥ 55 to 60 dBm	35 to 40 dB
≥ 50 to 55 dBm	30 to 35 dB
≥ 45 to 50 dBm	25 to 30 dB
≥ 40 to 45 dBm	20 to 25 dB
≥ 35 to 40 dBm	15 to 20 dB
≥ 30 to 35 dBm	10 to 15 dB
≥ 25 to 30 dBm	5 to 10 dB
≥ 20 to 25 dBm	0 to 5 dB
< 20 dBm	0 dB

- For signal measurements at the output of two-port networks, connect the reference frequency of the signal source to the rear reference input of the analyzer (*EXT REF IN/OUT*).

  To ensure that the error limits specified by the 3GPP standard are met, the analyzer should use an external reference frequency for frequency measurements on base stations. A rubidium frequency standard may be used for instance as a reference source.

- If the base station is provided with a trigger output, connect this output to the rear trigger input of the analyzer (*EXT TRIG GATE*).

Presetting

- Enter external attenuation (reference level offset)
- Enter reference level
- Enter center frequency
- Set the trigger
- Select standard and measurement

4 WCDMA Test Model

For measurements on base-station signals in line with 3GPP, test models with different channel configuration are specified in the document "Base station conformance testing (FDD)" (3GPP TS 25.141 V3.7.0). An overview of the test models is given in this chapter.

All configurations for test models contain the special channel PICH (Paging Indication Channel). Since the channel contains no pilot symbols, it cannot be automatically identified by the CDP analysis. For measurements on signals containing the PICH, the CDP analysis must therefore be performed in the *CODE CHAN PREDEFINED* mode. In this mode, the 3GPP test models can be used for the measurement at a keystroke (for a detailed description refer to softkey *CODE CHAN PREDEFINED*).

Table 4-1 Test model 1

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset ($x256T_{chip}$)
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
SCCPCH (SF=256)	1	1.6	-18	3	150
DPCH (SF=128)	16/32/64	76.8 total	see TS 25.141	see TS 25.141	see TS 25.141

Table 4-2 Test model 2

Channel type	Number of channels	Power(%)	Level (dB)	Spreading code	Timing offset ($x256T_{chip}$)
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	5	-13	16	120
SCCPCH (SF=256)	1	5	-13	3	150
DPCH (SF=128)	3	2 x 10,1 x 50	2 x –10, 1 x –3	24, 72, 120	1, 7, 2

Table 4-3 Test model 3

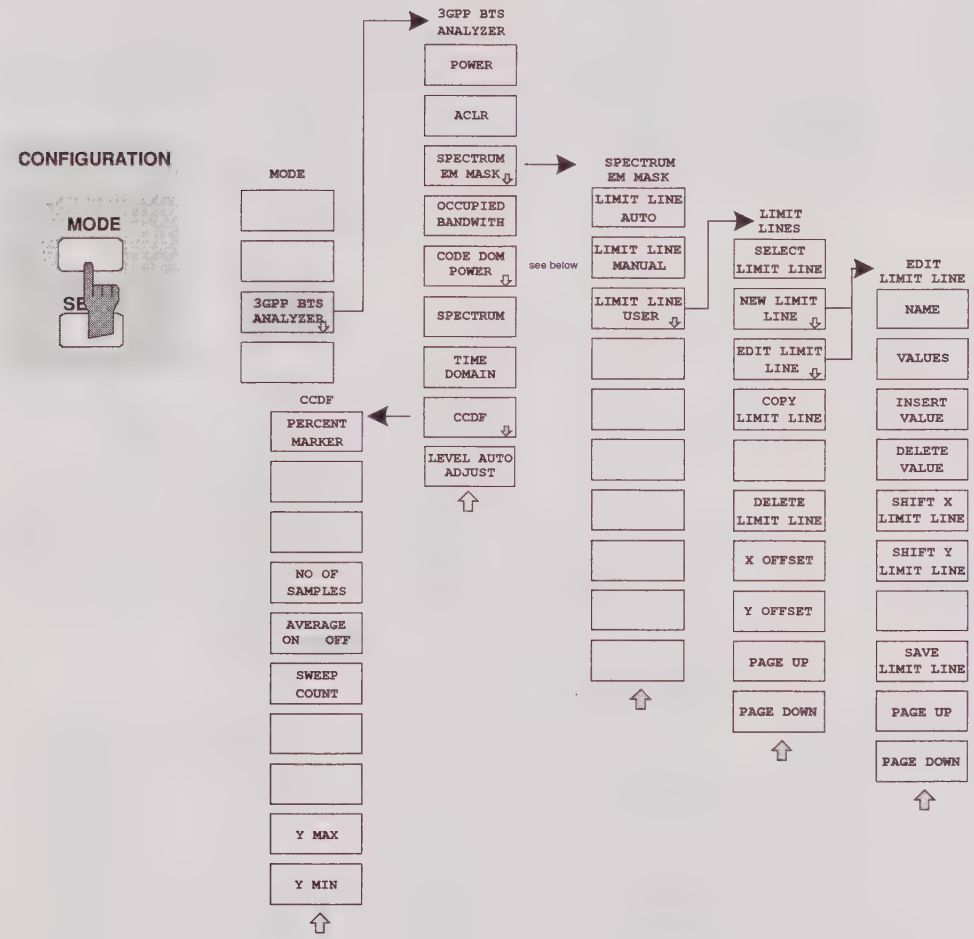
Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset ($x256T_{chip}$)
PCCPCH+SCH	1	12,6/7,9	-9 / -11	1	0
Primary CPICH	1	12,6/7,9	-9 / -11	0	0
PICH	1	5/1.6	-13 / -18	16	120
SCCPCH (SF=256)	1	5/1.6	-13 / -18	3	150
DPCH (SF=256)	16/32	63,7/80,4 total	see TS 25.141	see TS 25.141	see TS 25.141

Table 4-4 Test model 4

Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset ($x256T_{chip}$)
PCCPCH+SCH	1	50 to 1.6	-3 to -18	1	0
Primary CPICH	1	10	-10	0	0

5 Menu Overview

Application Firmware Module FSIQK72 (WCDMA base station test) extends the analyzer by the code domain measurement mode for 3GPP WCDMA standard. Additional softkeys are available which allow overview measurements in the analyzer and vector analyzer modes.



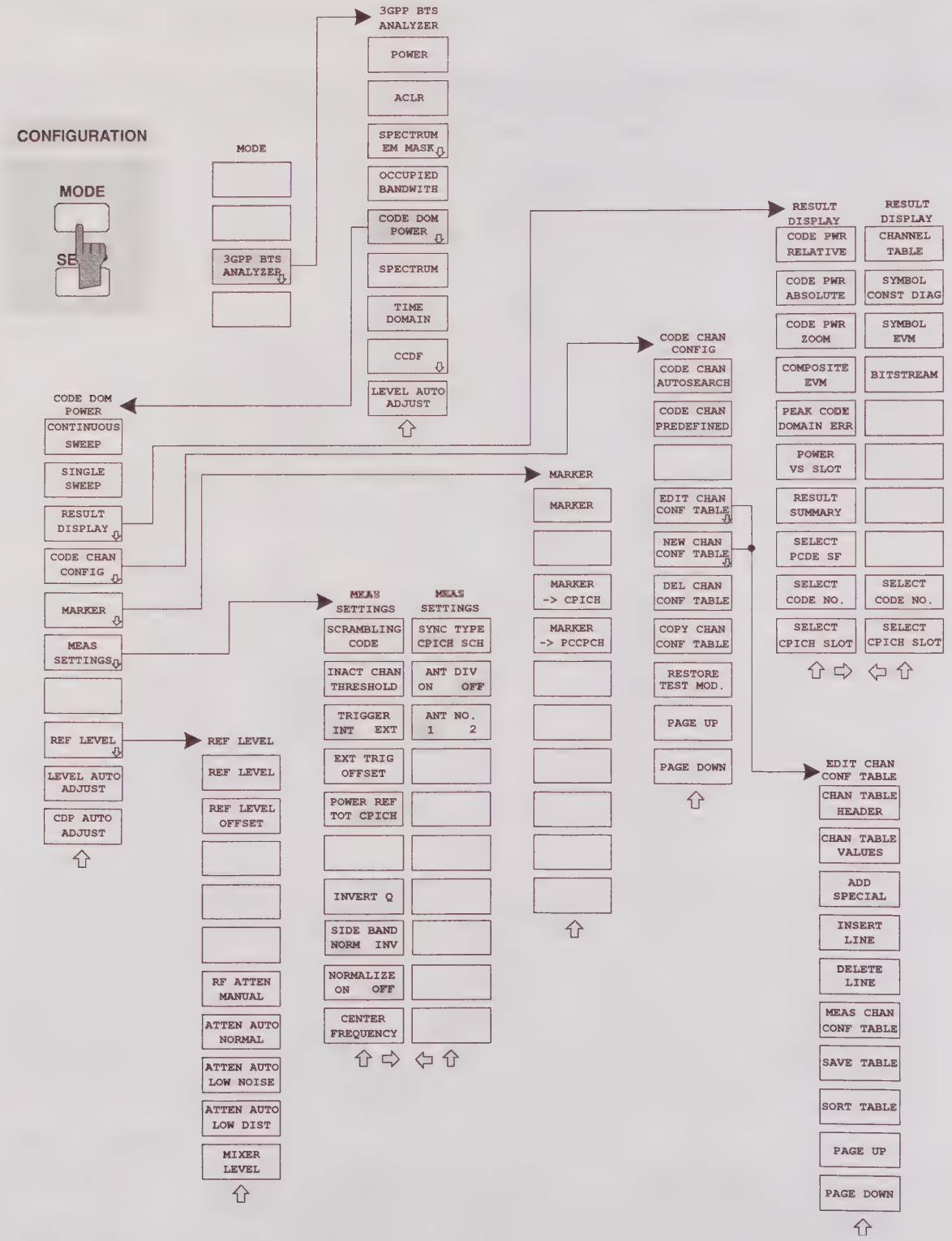


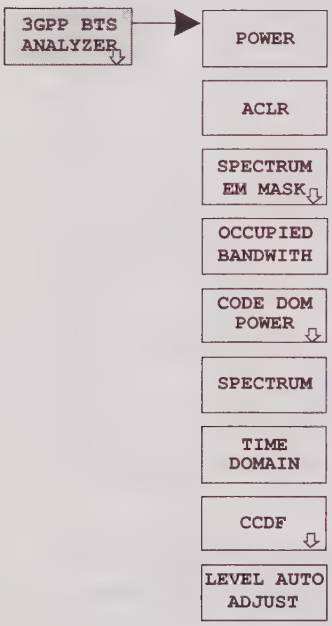
Fig. 5-1 Overview of menus

6 Configuration of WCDMA Measurements

The most important parameters for the 3GPP WCDMA base station tests are summarized in the menu *cdmaOne BTS* (*CONFIGURATION* key group, *Mode* key) and are explained below using the softkey functions.

The *CDP MEAS* softkey activates the code domain measurement mode and opens the submenus for setting the measurement.
The softkeys *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH*, *SPECTRUM*, *TIME DOMAIN* and *CCDF* activate base station tests in the analyzer or vector analyzer mode. The settings required by 3GPP specifications are performed by pressing the associated softkey, a subsequent modification of settings is possible. The other menus of FSIQ correspond to the menus of these modes and are described in the operating manual of FSIQ.

CONFIGURATION MODE menu



The *3GPP BTS ANALYZER* softkey opens a submenu for setting the various measurement modes of option FSIQK72:

- *POWER* activates the channel power measurement with defined settings in the analyzer mode.
- *ACLR* activates the adjacent channel power measurement with defined settings in the analyzer mode.
- *SPECTRUM EM MASK* compares the signal power in different carrier offset ranges with the maximum values specified by 3GPP.
- *OCCUPIED BANDWIDTH* activates the measurement of the occupied bandwidth (analyzer mode).
- *CODE DOM POWER* activates the code domain measurement mode and opens another submenu for selecting and configuring the parameters. All other menus of FSIQ are adapted to the functions of the code domain measurement mode.
- *SPECTRUM* activates an overview measurement with defined settings in the analyzer mode.
- *TIME DOMAIN* activates the measurement of the WCDMA signal CREST factor in the time domain display mode (analyzer mode).
- *CCDF* evaluates the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).

Measurement of Channel Power

Submenu: *CONFIGURATION- MODE – 3GPP BTS ANALYZER – POWER*

The *POWER* softkey activates the measurement of the WCDMA signal channel power.

FSIQ measures the RF signal power in the 3.84 MHz bandwidth. The power is calculated by summing up the values at the trace points. The individual trace points are weighted with the root raised cosine function as specified by the 3GPP standard. The bandwidth is displayed numerically in the marker info field at the top right edge of the screen.

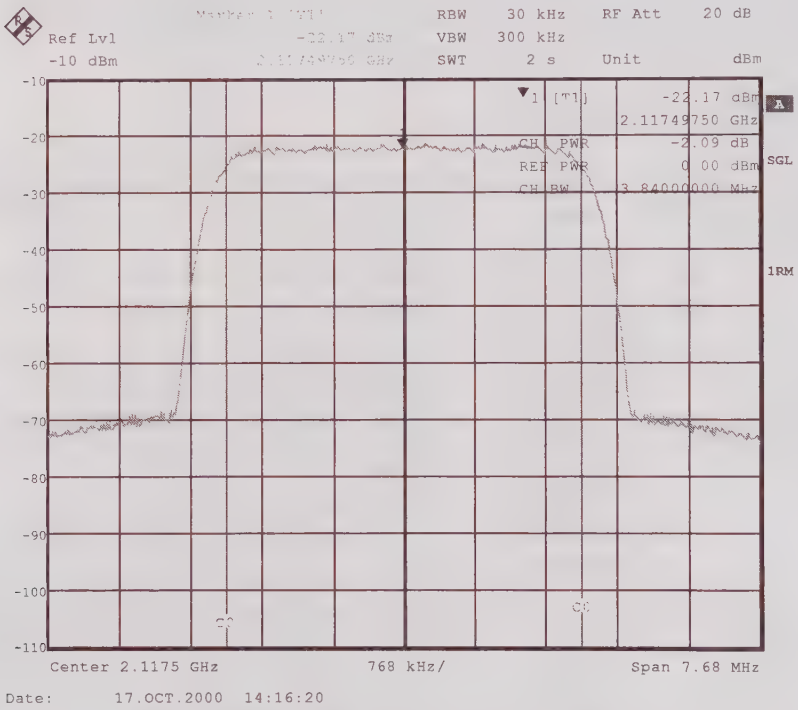


Fig. 6-1 Power measurement in the 3.84 MHz transmission channel

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After Preset the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings		
MARKER NORMAL	CHANNEL POWER	
MARKER NORMAL	POWER MEAS SETTINGS - ACP STANDARD	W-CDMA 3GPP FWD

Starting from these settings, FSIQ can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command: `:CONFigure:WCDPower:MEASurement POWer`

Query of results: `:CALCulate:MARKer:FUNCtion:POWer:RESult? CPOWer`

Measurement of Adjacent-Channel Power - ACLR

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER*

The *ACLR* softkey activates the adjacent-channel power measurement in the default setting according to 3GPP specifications (Adjacent Channel Leakage Power Ratio).

FSIQ measures the channel power and the relative power of adjacent channels and of the next channels. The results are displayed in the marker info field at the top right edge of the screen.

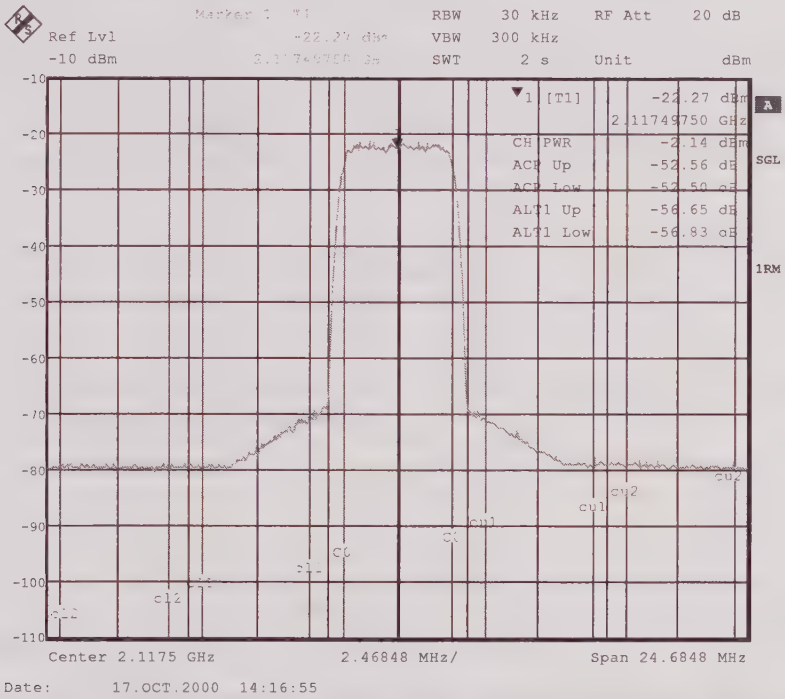


Fig. 6-2 Adjacent-channel power measurement of a WCDMA base station.

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After Preset the following user-specific settings are restored and so the adaptation to the DUT is maintained:	Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings	
MARKER NORMAL	ADJACENT CHAN POWER	
MARKER NORMAL	POWER MEAS SETTINGS - ACP STANDARD	W-CDMA 3GPP FWD
	SET NO OF ADJ CHAN'S	2

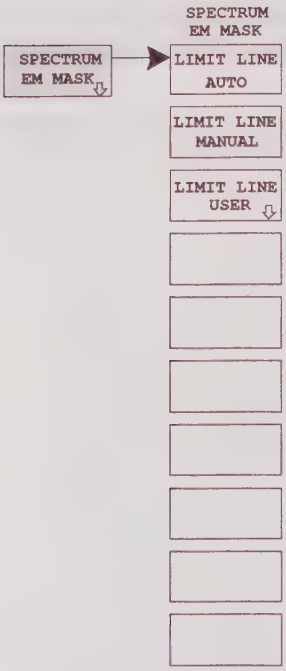
Starting from these settings, FSIQ can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command: `:CONFigure:WCDPower:MEASurement ALCR`

Query of results: `:CALCulate:MARKer:FUNCtion:POWer:RESult? ACPower`

Signal Power Check – SPECTRUM EM MASK

CONFIGURATION - MODE - 3GPP BTS ANALYZER submenu



The *SPECTRUM EM MASK* softkey starts the determination of the power of the WCDMA signal in defined offsets from the carrier and compares the power values with a spectral mask specified by 3GPP.

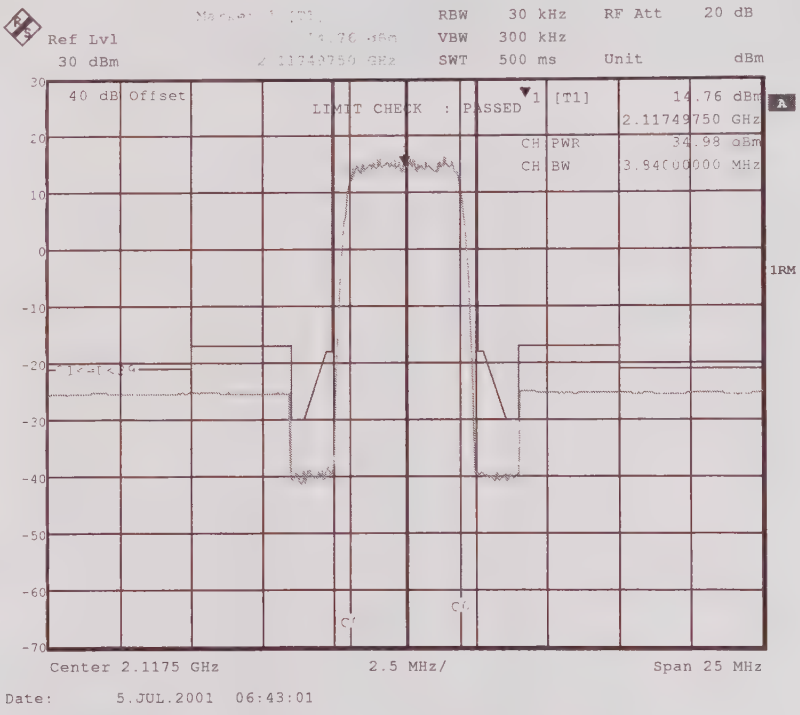


Fig. 6-3 Measurement of Spectrum Emission Mask.

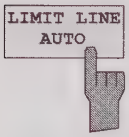
Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After Preset the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings		
MARKER NORMAL	CHANNEL POWER	
MARKER NORMAL	POWER MEAS SETTINGS - ACP STANDARD	W-CDMA 3GPP FWD
	SET NO OF ADJ CHAN'S	0
MARKER NORMAL	CP / ACP ABS / REL	ABS
FREQUENCY SPAN		25 MHz
	CENTER FIXED	
SWEEP SWEEP	SWEEP TIME MANUAL	0.5 sec
TRACE 2/3/4	DETECTOR	RMS

Starting from these settings, FSIQ can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command: `:CONFigure:WCDPower:MEASurement ESPectrum`

Query of results: `:CALCulate:LIMit:FAIL?` and visual evaluation



The *LIMIT LINE AUTO* softkey automatically selects the limit line to be checked according to power determined in the useful channel. If the measurement is carried out in *CONTINUOUS SWEEP* and the channel power changes from sweep to sweep, this can result in the limit line being continuously redrawn.
The softkey is activated when the spectrum emission mask measurement is entered.

IEC/IEEE-bus command: `:CALC:LIM:ESP:MODE AUTO`

The *LIMIT LINE MANUAL* softkey activates the manual selection of a predefined limit line . If this softkey is selected, the channel power measurement is not used to select the limit line, but only to determine its relative components. The power at the different frequency offsets is compared with the user-defined limit line.

The softkey opens a table with all the limit lines predefined in the device:

P >= 43 dBm
39 dBm <= P < 43 dBm
31 dBm <= P < 39 dBm
P < 31 dBm

The name of the limit line indicates the expected power range, for which the limit line has been defined.

IEC/IEEE-bus command:
```
:CALC:LIM:ESP:MODE MANual
:CALC:LIM:ESP:VALue 39
```

The *LIMIT LINE USER* softkey activates the input of user-defined limit lines. The softkey opens the menus of the limit line editor that are known from the basic unit. The limit lines created by the user are included in the table for *LIMIT LINE MANUAL.*
The following limit line settings are useful for base station tests:
Trace 1, Domain Frequency, X-Scaling relative, Y-Scaling absolute, Spacing linear, Unit dBm
In contrast to the predefined limit lines supplied with the FSIQ which correspond to the standard specifications, the user-defined limit line can be specified for the entire frequency range (±12.5 MHz from carrier) either relatively (referred to the channel power) or absolutely.

IEC/IEEE-bus command: see Table of Softkeys with Assignment of IEC/IEEE Commands

Measurement of Occupied Bandwidth - OCCUPIED BANDWIDTH

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER*

The *OCCUPIED BANDWIDTH* activates the measurement of the bandwidth which the signal occupies.

The occupied bandwidth is defined as the bandwidth in which 99% of the total transmitter power is contained.
The occupied bandwidth and the frequency markers are output in the marker info field at the top right edge of the screen.

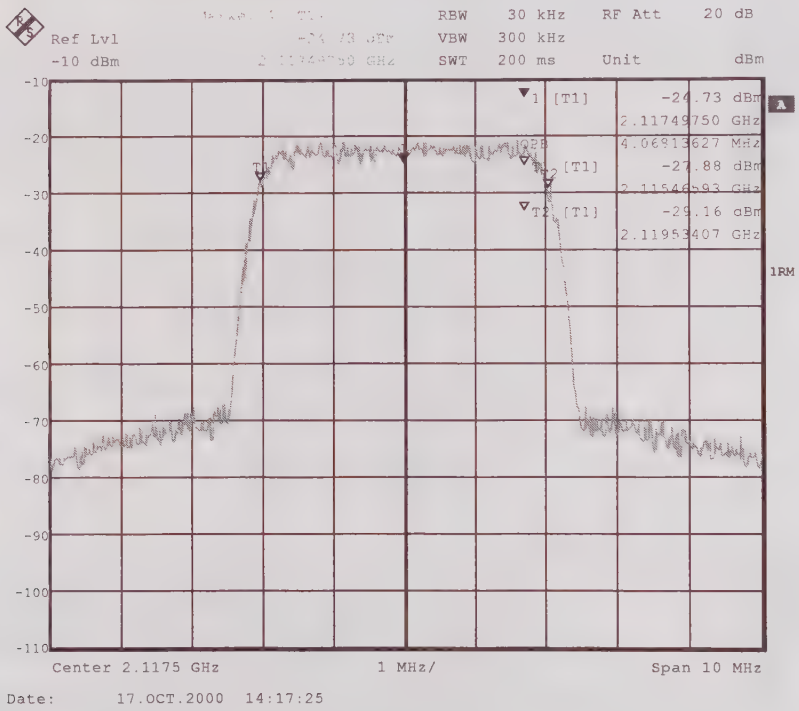


Fig. 6-4 Measurement of occupied bandwidth.

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After Preset the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings		
MARKER NORMAL	OCCUPIED PWR BANDW	
FREQUENCY SPAN		10 MHz
SWEEP SWEEP	SWEEP TIME MANUAL	0.2 sec
SWEEP COUPLING	RBW MANUAL	30 kHz
TRACE 1	DETECTOR	RMS

IEC/IEEE-bus command: `:CONFigure:WCDPower:MEASurement OBANdwidth`

Query of results: `:CALCulate:MARKer:FUNCtion:POWer:RESult? OBANdwidth`

Spectrum Measurement - SPECTRUM

Submenu: *CONFIGURATION- MODE - 3GPP BTS ANALYZER*

The *SPECTRUM* softkey displays the spectrum of the WCDMA BTS signal with a span of 25 MHz in the analyzer mode.

This measurement gives an overview of the W-CDMA signal spectrum so that interfering signals in the immediate vicinity can be identified. Measurement settings, e.g. the span, can be modified as required for further signal measurements.

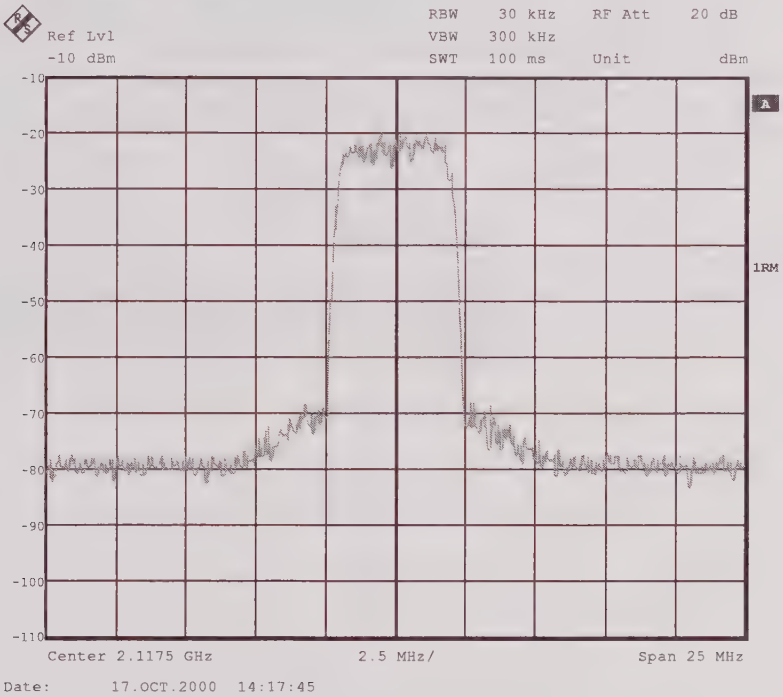


Fig. 6-5 Spectrum display of WCDMA signal at a 25 MHz span.

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After Preset the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings		
FREQUENCY SPAN		25 MHz
SWEEP SWEEP	SWEEP TIME MANUAL	0.1 sec
SWEEP COUPLING	RES BW MANUAL	30 kHz
TRACE 1	DETECTOR	RMS

Starting from these settings, FSIQ can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command: `:CONFigure:WCDPower:MEASurement FDOMain`

Query of results: -- (visual evaluation)

Measurement of Crest Factor - TIME DOMAIN

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER*

The *TIME DOMAIN* softkey displays the CREST factor of the WCDMA BTS signal in the analyzer mode.

For this measurement, a signal section is continuously recorded.
The W-CDMA signal is measured in the zero span in the time domain. The result is displayed in two traces.
Trace 1 is measured with the sample detector. The analyzer calculates the average power from the displayed trace points.
Trace 2 is measured with the peak detector in the max. hold mode, i.e. the peak value of the signal is displayed.
The analyzer calculates the crest factor from the difference between the peak and the average power and displays it in the Marker Info field.

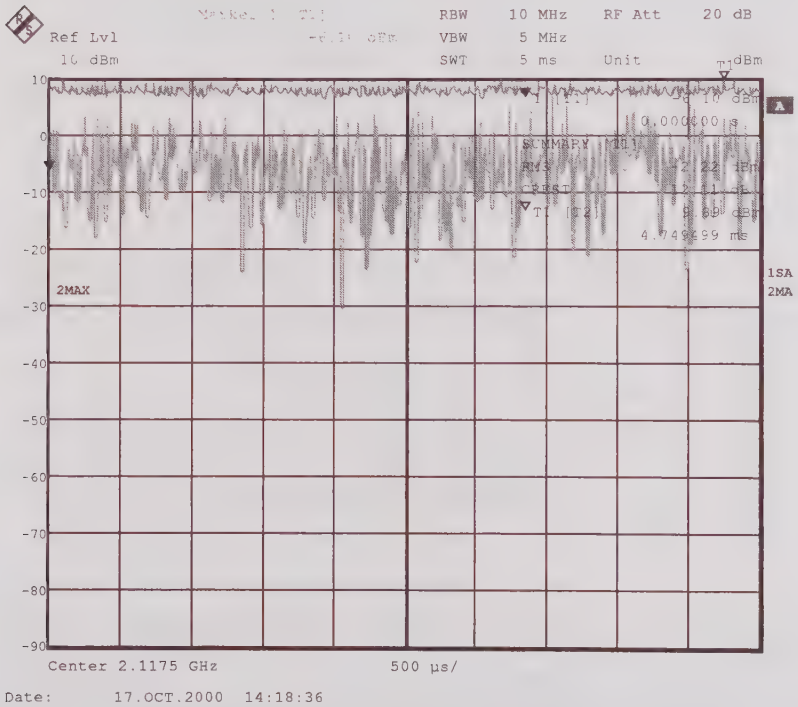


Fig. 6-6 Time domain display of WCDMA signal.

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After Preset the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings		
FREQUENCY SPAN		ZERO SPAN
SWEEP SWEEP	SWEEP TIME MANUAL	0.1 sec
SWEEP COUPLING	RES BW MANUAL	10 MHz
	VIDEO BW MANUAL	5 MHz
TRACE 1	DETECTOR	SAMPLE
MARKER NORMAL		MARKER 1
TRACE 2		MAX HOLD
TRACE 2	DETECTOR	MAX PEAK
MARKER SEARCH	SUMMARY MARKER	ON
MARKER SEARCH	SUMMARY MARKER	RMS
MARKER NORMAL	MARKER INFO	ON

Starting from these settings, FSIQ can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command:

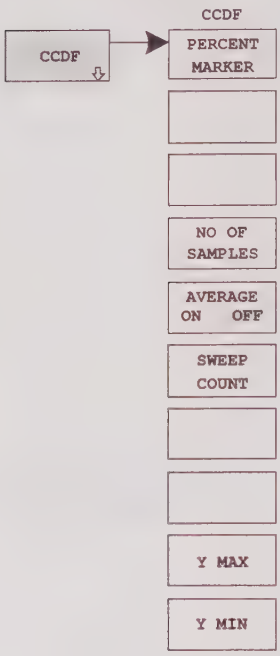
```
:CONFigure:WCDPower:MEASurement TDOMain
```

Query of results:

```
:CALCulate:MARKer:FUNCtion:CRESt?
:CALCulate:MARKer:FUNCtion:SUMMary:RMS:RESult?
:CALCulate:MARKer:FUNCtion:SUMMary:STATe ON
```

Signal Statistics - CCDF

CONFIGURATION - MODE - 3GPP BTS ANALYZER sub menu



The CCDF softkey starts a measurement of the distribution function of the signal amplitudes (complementary cumulative distribution function).

For the purposes of this measurement, a signal section of settable length is recorded continuously in the zero span, and the distribution of the signal amplitudes is evaluated. The record length and display range of the CCDF can be set using the softkeys of the menu. The amplitude distribution is displayed logarithmically as a percentage of the amount by which a particular level is exceeded, beginning with the average value of the signal amplitudes.

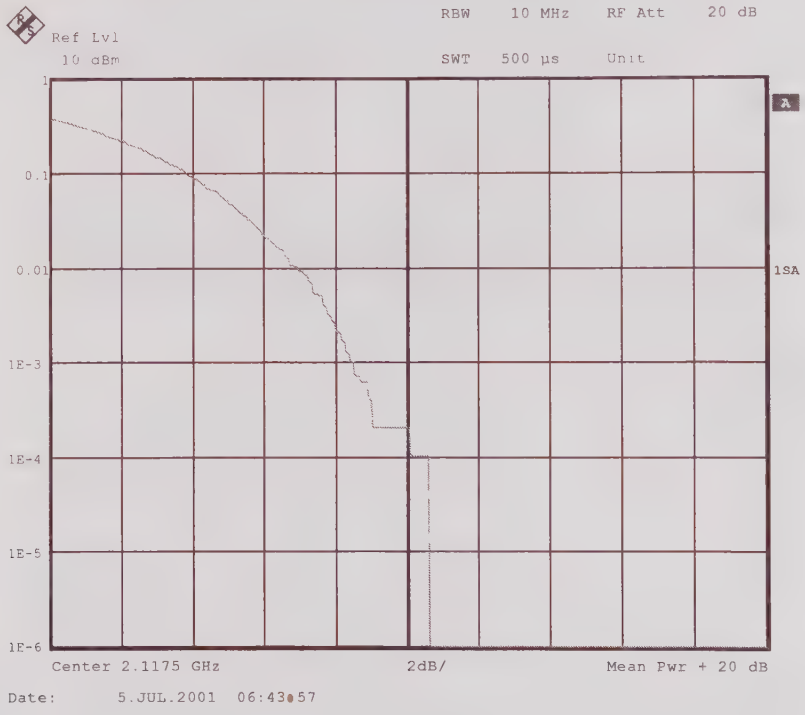


Fig. 6-7 CCDF of WCDMA signal.

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After Preset the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings		
FREQUENCY SPAN		ZERO SPAN
TRACE1	DETECTOR	SAMPLE
SWEEP COUPLING	RES BW MANUAL	10 MHz
	VIDEO BW MANUAL	5 MHz

Starting from these settings, FSIQ can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command: `:CONFigure:WCDPower:MEASurement CCDF`
or
`:CALCulate:STATistics:CCDF ON`

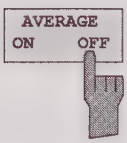
Query of results: `:CALCulate:MARKer:X?`

The *PERCENT MARKER* softkey sets the marker to the specified percentage of the Y axis. The step width of the marker movement depends on the current marker value.
In addition to this marker, the normal markers of the analyzer can be activated for the display mode.

IEC/IEEE-bus command: `:CALC:MARK:Y:PERC 5`

The *NO OF SAMPLES* softkey specifies the number of samples used to create the CCDF.

IEC/IEEE-bus command: `CALC:STAT:NSAM 5000`



The *AVERAGE ON / OFF* softkey specifies whether or not the results of continuous measurements (in conjunction with *SWEEP COUNT*) are averaged. The default setting of the softkey is *OFF*.

IEC/IEEE-bus command: `:DISP:TRAC1:MODE AVER | VIEW`

The *SWEEP COUNT* softkey determines the number of signal sections across which averaging is carried out (in the case of *AVERAGE ON*). Using *SWEEP COUNT* >1 and *AVERAGE ON*, the number of samples used to evaluate the statistical characteristics of the signal can be increased.

IEC/IEEE-bus command: `:SWE:COUN 6`

The *Y MAX* softkey specifies the upper limit of the display range of the CCDF. Since probabilities are specified on the Y axis, the entered numerical values are dimensionless. The maximum value of the softkey is 1.

IEC/IEEE-bus command: `CALC:STAT:SCAL:Y:UPP 0.01`

The *Y MIN* softkey specifies the lower limit of the display range of the CCDF. The minimum value of the softkey is 1E-6.

IEC/IEEE-bus command: `CALC:STAT:SCAL:Y:LOW 0.001`

Code Domain Measurements on WCDMA Signals

Application Firmware FSIQK72 provides the peak code domain error measurement, an EVM measurement of the total signal (composite EVM), prescribed by the 3GPP standard as well as the code domain power measurement of assigned and unassigned codes. In addition, the symbols demodulated in a slot, the decided bits or the EVM symbol can be displayed for an active channel.

A signal section of approx. 20 ms is recorded for analysis and searched for the start of a WCDMA frame. If a frame start is found in the signal, the CDP analysis is performed for a complete frame starting from slot 0.
Because of the power control over one power group prescribed by the 3GPP specification, permitting the channel power for a specific slot to be controlled at the beginning of the pilot symbol of the preceding slot, the signal has to be shifted in the memory in such a way that the WCDMA frame start is preceded by at least 1024 chips (longest sequence of pilot symbols).
Because of this shift and without triggering it may happen, however, that the recorded signal does not allow the analysis of a complete frame to start from slot 0. In this case, FSIQK72 will start the CDP analysis from the first complete slot in the memory instead from slot 0. The 15 slots following the first complete one will be analyzed.
With triggering (frame trigger) and a trigger offset of 0 the CDP analysis for a complete WCDMA frame cannot start from slot 0 because of the shifting of the signal in the memory. In this case, FSIQK72 will typically start CDP analysis from slot 1. With a trigger offset of –266,67 µs (= 1024 chips) the start of the analysis can be shifted to slot 0.

The start slot of the CDP analysis can be seen in all graphs where the x axis is referenced to the slot. A detailed description is given with the respective display modes.

Application firmware FSIQK72 offers two different ways of representing the code domain power measurement:

- Representation of all code channels

  Option FSIQK72 displays the power of all occupied code channels in a bargraph. The x axis is scaled for the highest code class or the highest spreading factor (512). Code channels with a lower spreading factor occupy correspondingly more channels of the highest code class. The power of the code channel is always correctly measured in accordance with the actual power of the code channel. Unused code channels are assumed to belong to the highest code class and displayed accordingly. The displayed power of an unused code channel therefore corresponds to the power of a channel with the spreading factor 512 at the respective code position.
  To simplify identification, used and unused channels are displayed in different colours. Used channels are yellow, unused channels are blue.
  The measured power always refers to one slot. The time reference for the start of a slot is the CIPCH slot. When a timing offset is used this means that the power measurement period does not have to be identical for the various code channels as the beginning of the channel slot depends on the timing offset.

- Representation of channel power versus slots of a WCDMA signal frame

  In this case the power of a selectable code channel is indicated versus a frame. The power is always measured within one slot of the selected channel. If code channels contain a timing offset, a specific slot of each channel is started at a different time. The offset to the beginning of the CPICH slot may be as long as one frame. The time reference for the display (x axis) is the CPICH. The power displayed for the measured code channel is however referred to the physical time at which it actually occurs. The timing offset of all power-controlled code channels can thus be directly read in the measured trace.

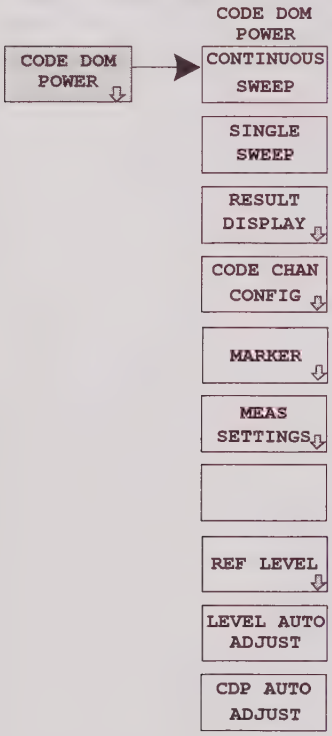
For all measurements performed in a slot of a selected channel (bits, symbols, EVM), the actual slot spacing of the channel is taken as a basis.
The composite EVM and peak code domain error measurements are always referred to the total signal.
For code domain power (CDP) measurements, the display is operated in the SPLIT SCREEN mode. Only the display modes for the codes of the class with the highest spreading factor are permitted in the upper part of the screen, all other display modes are assigned to the lower part of the screen.

FSIQK72 expects the following synchronization channels for the code domain power measurements.

- Common pilot channel (CPICH),
- Primary common control physical channel (PCCPCH),
- Primary synchronization channel (PSCH),
- Secondary synchronization channel (SSCH).

There are two modes for the CDP analysis. In the *CODE CHAN AUTOSEARCH* mode, FSIQK72 performs an automatic search for active channels in the whole code domain. The search is based on the presence of known symbol sequences (pilot sequences) in the despread symbols of a channel. Channels without pilot sequences, such as the PICH contained in the test models, cannot be detected as being active in this mode. In the *CODE CHAN PREDEFINED* mode, the user can define the active channels contained in the signal via tables that can be selected and edited. For these channels a channel search by comparison with pilot sequences is no longer performed. In this mode, special channels without pilot sequences (which should be in the code domain however) can therefore be taken into account by FSIQK72 for the CDP analysis.

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER*



The *CODE DOM POWER* softkey activates the code domain measurement mode and opens a submenu for configuring the measurements.
All settings can be performed in these submenus.

IEC/IEEE-bus command:

```
:CONFigure:WCDPower:MEASurement WCDPower
```

or:

```
:INSTrument:SELect WCDPower
```

Query of results:

```
:TRACe:DATA?  TRACE1|TRACE2|ABITstream|PWCDp|CTABle
```

or

```
:CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower:RESult?
    PTOTal | FERRor |TFRame | TOFFset | MACCuracy |
    PCDerror | EVMRms | EVMPeak | CERRor | CSLot |
    SRATe |CHANnel | CDPabsolute | CDPRelative |
    IQOFfset | IQIMbalance
```

or

Marker functions (see MARKER submenu)

Continuous Measurement - Continuous Sweep

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER*

The *CONTINUOUS SWEEP* softkey sets a continuous measurement mode. The start of the actual measurement, however, may depend on an external trigger. (see section Trigger Settings - TRIGGER Menu)

IEC/IEEE-bus command: `:INITiate:CONTinuous ON;`
`:INITiate:IMMediate`

Single Measurement - Single Sweep

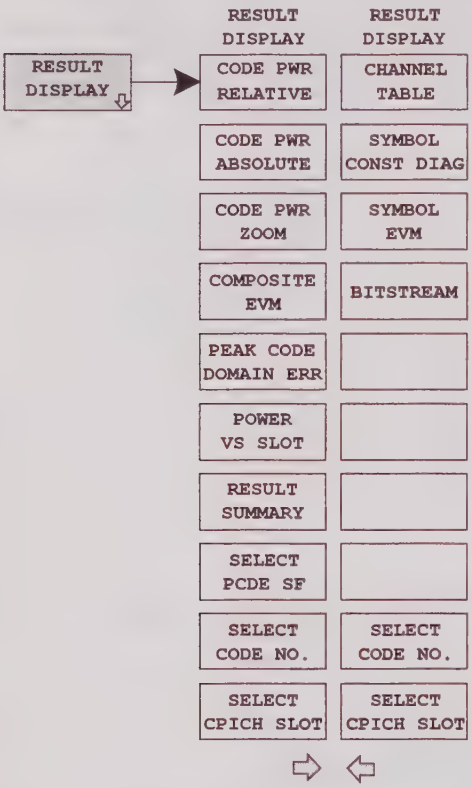
Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER*

The *SINGLE SWEEP* softkey sets the single measurement mode. A single sweep is performed upon pressing the softkey. The start of the actual measurement, however, may depend on an external trigger (see section Key group SWEEP).

IEC/IEEE-bus command: `:INITiate:CONTinuous OFF;`
`:INITiate:IMMediate`

Display Mode - RESULT DISPLAY

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER*



The *RESULT DISPLAY* softkey opens a submenu for setting the display mode. The main menu contains the most important display modes as well as the measurements specified by the 3GPP standard for a fast access, whereas the side menu contains more detailed display modes.

The following display modes are available:

CODE PWR RELATIVE
: Code domain power with relative scaling

CODE PWR ABSOLUTE
: Code domain power with absolute scaling

CODE PWR ZOOM
: Selection of 64 codes out of the 512 possible codes

COMPOSITE EVM
: Square difference between test signal and ideal reference signal

PEAK CODE DOMAIN ERR
: Projection of the error between the test signal and the ideal reference signal onto the various spreading factors and subsequent summation using the symbols of each difference signal slot

POWER VS SLOT
: Power of the selected channel versus all slots of a WCDMA signal frame

RESULT SUMMARY
: Tabular result display

CHANNEL TABLE
: Display of channel occupation table

SYMBOL CONST DIAG
: Display of constellation diagram

SYMBOL EVM
: Display of error vector magnitude diagram

BITSTREAM
: Display of decided bits

By entering a code number (*SELCT CODE NO:* softkey) in the modes *CODE PWR RELATIVE /ABSOLUTE / ZOOM, POWER VS SLOT, SYMBOL CONST DIAG / EVM* it is possible to mark a channel for more detailed display modes.

The desired spreading factor can be selected with the *SELECT PCDE SF* softkey in the *PEAK CODE DOMAIN* display mode.

In the *POWER VS SLOT*, *SYMBOL CONST DIAG* and *SYMBOL EVM* display modes a slot can be marked by entering a slot number using the *SELECT CPICH SLOT* softkey.

Above the diagram, the most important measurement settings which form the basis if the display modes are summarized:

CF	2.1175 GHz	SR	30 ksps
Code Pwr Relative		Chan Code	27
CPICH Slot	10	Chan Slot	1

Fig. 6-8 Indication of measurement parameters

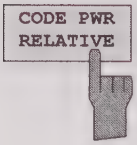
The different elements are:
1st column:

CF 2.1175 GHz:	Center frequency of signal
Code Pwr Relative:	Name of selected display mode
CPICH Slot 10:	CPICH slot number (value of SELECT CPICH SLOT softkey)

2nd column:

SR 30 ksps:	Symbol rate of selected channel
Chan Code 27:	Spreading code of selected channel
Chan Slot 1:	Slot number of selected channel

Note: *For the peak code domain error display mode, the indication of the symbol rate is replaced by the indication of the spreading factor onto which the error is projected (see PEAK CODE DOMAIN ERR softkey)*



The *CODE PWR RELATIVE* softkey selects the code domain power display mode with relative scaling.

In default mode, the power of the channels is referred to the CPICH power (code No. 0). This power reference was selected since the total power may vary depending on the slot due to the possibility of controlling the power in the different code channels. In contrast to the variable total power, the power of the CPICH is the same in all slots so that it can form the constant reference for the display. The reference can be switched to total power selecting setting *TOT* for the *POWER REF* softkey.

The measurement interval for determining the power of the channels is a slot in the CPICH (corresponding to a timing offset of 0 chip referred to the beginning of the signal frame).

The powers of the active channels and of the unassigned codes are shown in different colours:

- yellow: active channels
- blue: unassigned codes

In *CODE CHAN AUTOSEARCH* mode, a data channel is considered to be active if the pilot symbols as specified by standard 3GPP are at the end of each slot. In addition, the channel must exceed a minimum power (see INACT CHAN THRESHOLD softkey).
In *CODE CHAN PREDEFINED* mode, each data channel that is included in the user defined channel table is considered to be active.

By entering a code channel number (see *SELECT CODE NO* softkey) it is possible to mark a channel for more detailed display modes. The marked channel is shown in red. The whole channel is marked if it is an assigned channels, and only the entered code is marked in the case of an unassigned code.
Selecting other display modes (e.g. SYMBOL CONSTELLATION) for unassigned codes is possible but not useful since the results are not valid.

In the CDP diagram, the effect of missing or incomplete pilot symbols in a data channel can be shown in analyzer mode *CODE CHANNEL AUTOSEARCH*. At the points of the CDP diagram where the channel should appear due to its spreading code, there is a power value higher than the noise. The associated bars, however, are displayed in blue. In such a case, the channel should be checked for its pilot symbols. In *CODE CHANNEL PREDEFINED* mode, the channel should be included in the user defined channel table.

The figures show how the CDP is displayed when all active channels contained in the signal have been found and when one of the channels has been recognized as inactive, eg because of missing pilot symbols.

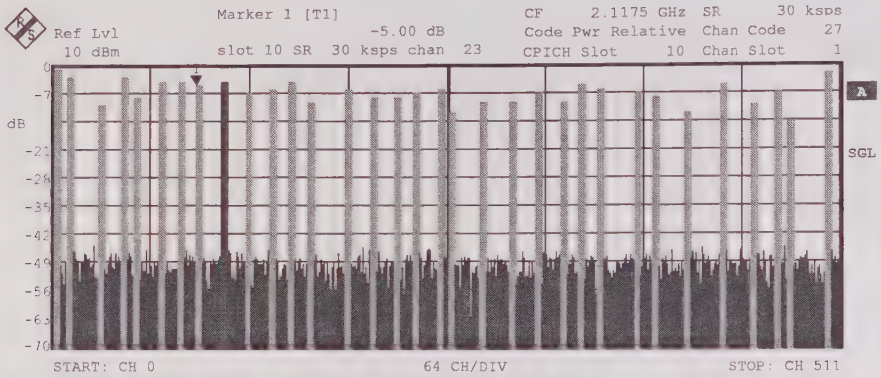


Fig. 6-9 CDP diagram (test model 1 without PICH) with all channels recognized as active

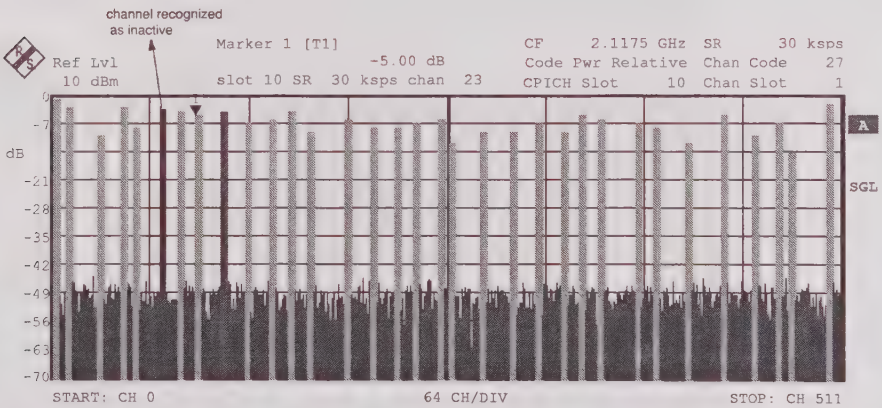


Fig. 6-10 CDP diagram (test model 1 without PICH) with one of the channels recognized as inactive

IEC/IEEE-bus command: `:CALCulate<1>:FEED "XPOW:CDP:RAT"`

The *CODE PWR ABSOLUTE* softkey selects the code domain power display mode with absolute scaling.

The powers of the active channels and of the unassigned codes are shown in different colours:

- yellow: active channels
- blue: unassigned codes

After entering a code number (*SELECT CODE NO* softkey) it is possible to mark a channel for other display modes. The marked channel is shown in red.

The measurement interval for determining the power of the channels is a slot in the CPICH (corresponding to a timing offset of 0 chip referred to the beginning of the signal frame).

For the recognition of the active code channels, the conditions are the same as those described for *CODE PWR RELATIVE*.

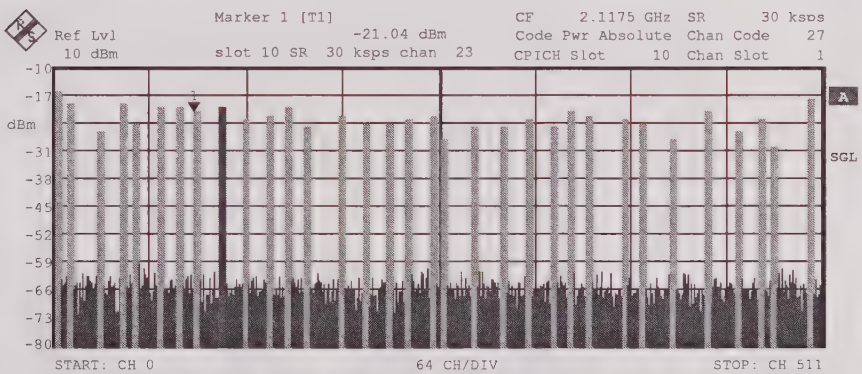
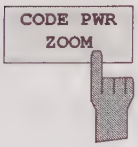


Fig. 6-11 Code domain power display mode with absolute scaling

IEC/IEEE-bus command: `:CALCulate<1>:FEED "XPOW:CDP"`



The *CODE PWR ZOOM* softkey zooms the x- axis of the code domain power display. The analyzer displays a window of 64 codes out of the 512 possible codes.

The representation is referred to the position of an activated marker. If no marker is active, the zoomed representation starts from code 0.

The powers of the active channels and of the unassigned codes are shown in different colours:

- yellow: active channels
- blue: unassigned codes

By entering a code channel number (see *SELECT CODE NO* softkey) it is possible to mark a channel for more detailed display modes. The marked channel is shown in red.
In the zoomed representation, the marked channel need not be contained in the displayed picture section. The display does not scroll depending on the marked channel.

The measurement interval for determining the power of the channels is a slot in the CPICH (corresponding to a timing offset of 0 chip referred to the beginning of the signal frame).

For the recognition of the active code channels, the conditions are the same as those described for CODE PWR RELATIVE.

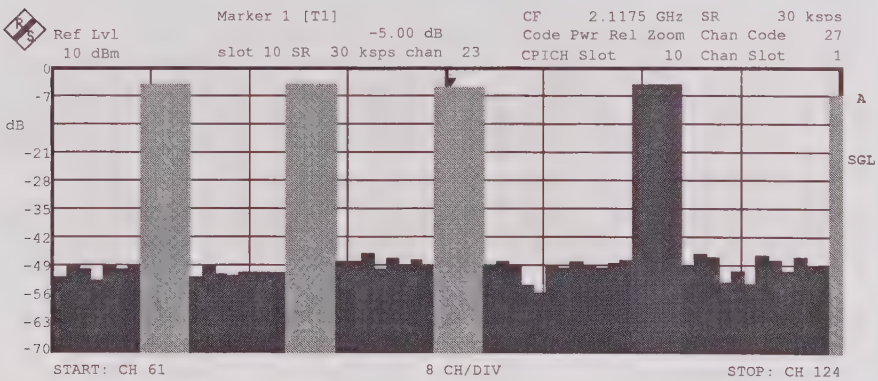


Fig. 6-12 Zoomed representation of the CDP diagram

IEC/IEEE-bus command: --

The *COMPOSITE EVM* softkey selects the composite EVM display mode.

During the composite EVM measurement, the square root of the squared errors between the real and imaginary parts of the test signal and an ideal reference signal (EVM referred to the total signal) is determined

The measurement result consists of one composite EVM measurement value per slot. In this case, the measurement interval is the slot spacing of the CPICH (timing offset of 0 chip referred to the beginning of the frame).

Only the channels recognized as active are used to generate the ideal reference signal. If an assigned channel is not recognized as active since pilot symbols are missing or incomplete, the difference between the measurement and reference signal, and the composite EVM is very high (see figures).

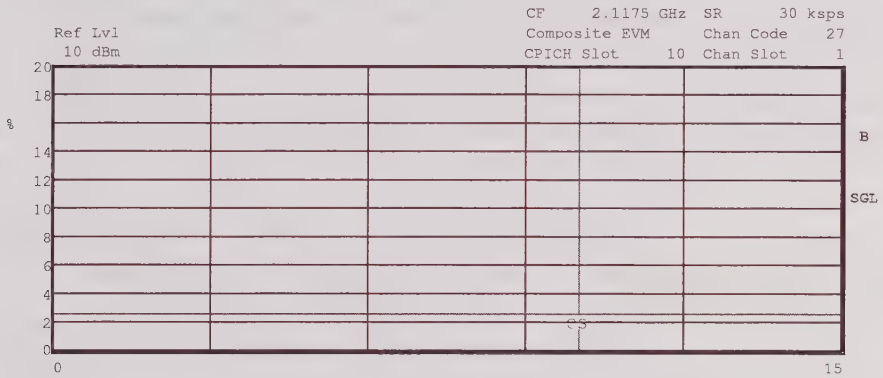


Fig. 6-13 Composite EVM - all channels are recognized as active

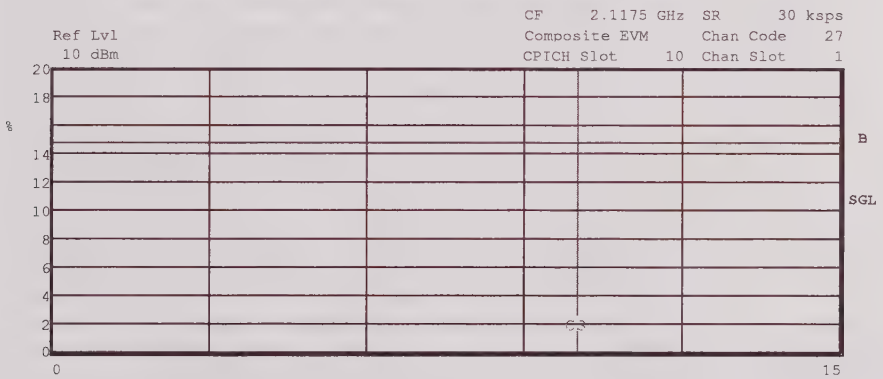


Fig. 6-14 Composite EVM - one channel is recognized as inactive

IEC/IEEE-bus command: `:CALCulate2:FEED "XTIM:CDP:MACCuracy"`

The *PEAK CODE DOM ERR* softkey selects the peak code domain error display mode.

In line with the 3GPP specifications, the error between the measurement signal and the ideal reference signal is projected onto the various spreading factors. The desired spreading factor is selected by means of the *SELECT PCDE SF* softkey.

The result consists of a numerical value per slot for the peak code domain error value. The measurement interval is the slot spacing of the CPICH (timing offset of 0 chip referred to the beginning of the frame).

Only the channels recognized as active are used to generate the ideal reference signal for the peak code domain error. If an assigned channel is not recognized as active since pilot symbols are missing or incomplete, the difference between the measurement and reference signal is very high. FSIQK72 consequently indicates a peak code domain error that is too high (see figures).

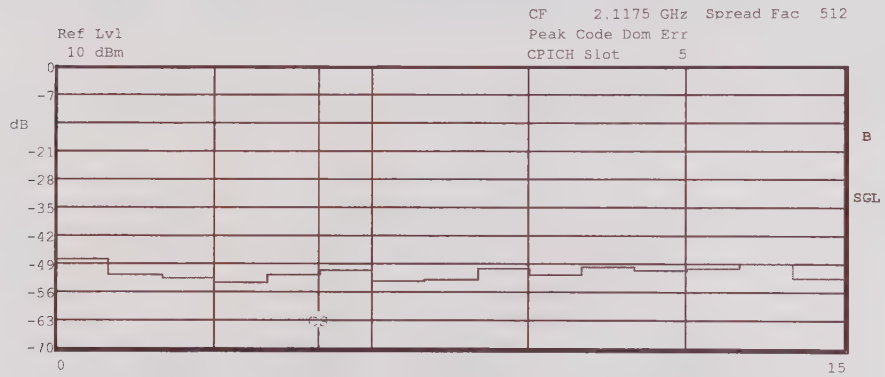


Fig. 6-15 Peak Domain Error - all channels are recognized as active

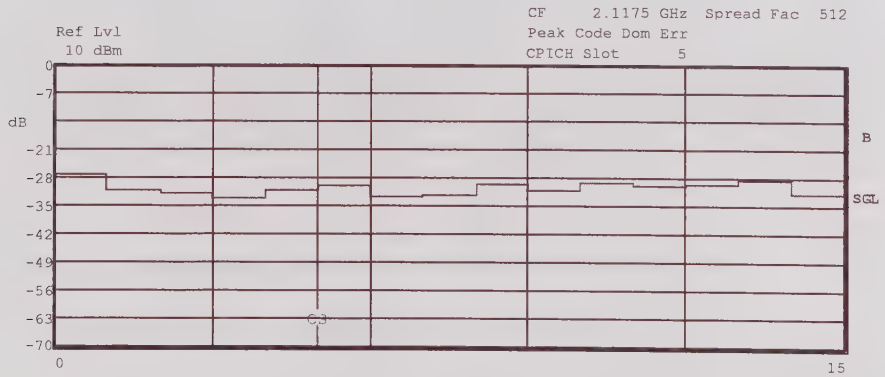
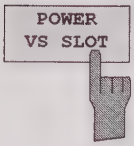


Fig. 6-16 Peak Domain Error - one channel is recognized as inactive

IEC/IEEE-bus command: `:CALCulate2:FEED "XTIM:CDP:ERR:PCDomain"`



The *POWER VS SLOT* softkey selects the indication of the power of the selected code channel depending on the slot number. The power of the selected channel (marked red in the CDP diagram) is displayed versus all slots of a frame of the WCDMA signal.

The 16 slots of the selected channel which follow the slot from which analysis starts are displayed. The following has to be taken into account: Due to the timing offset (up to one frame) admissible for the channels, the beginning of slot 0 of the selected channel is shifted with reference to the start of the frame (reference: CPICH slot 0). The timing offset therefore has also to be applied to the power-versus-slot display. To show the connection between timing offset and CDP analysis in the diagram, the x axis reflects the slot spacing of the channel as well as of the CPICH.

- The grid of the power-versus-slot display reflects the spacing of the CPICH slots. The slots are always labelled at the grid line where the slot in question begins (top labelling of x axis in diagram). The first CPICH slot displayed is the one from which the CDP analysis was started.
- The trace showing the powers versus the channel slots is displayed with a timing offset. The labelling of the channel slot numbers is displayed below the x axis at the beginning of the slot concerned (power group).

The following figures show an example of different results:

- Channel with a timing offset of 24832 chips referred to the CPICH (beginning of frame) with power control.

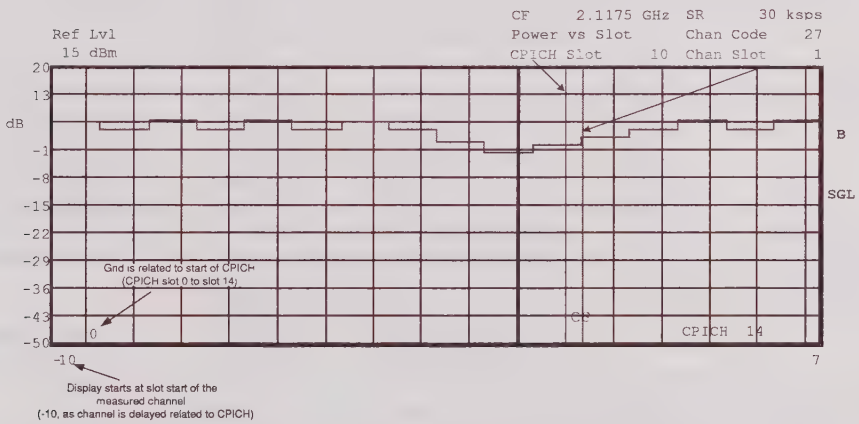


Fig. 6-17 Power versus Slot measurement for a channel with power control (timing offset 23 808)

- Channel with a timing offset of 2304 chips referred to the CPICH (beginning of frame) without power control.

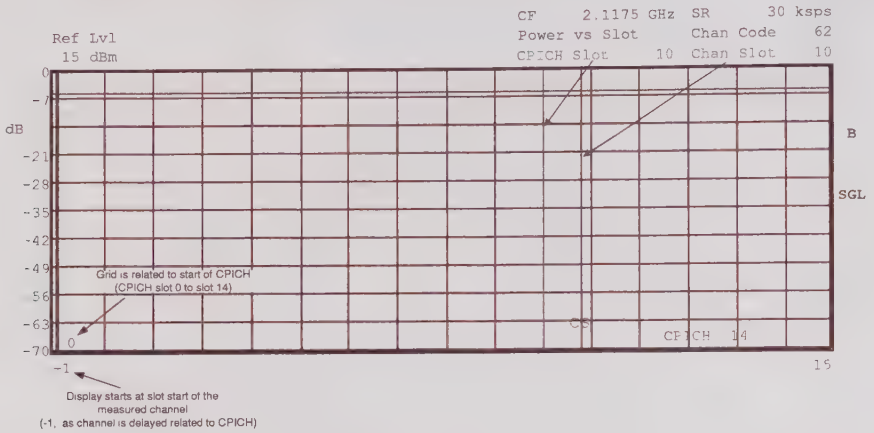


Fig. 6-18 Power versus Slot measurement for a channel without power control (timing offset 2304)

- Channel without timing offset from the CPICH (unassigned codes have a timing offset of 0 chip referred to beginning of the frame)

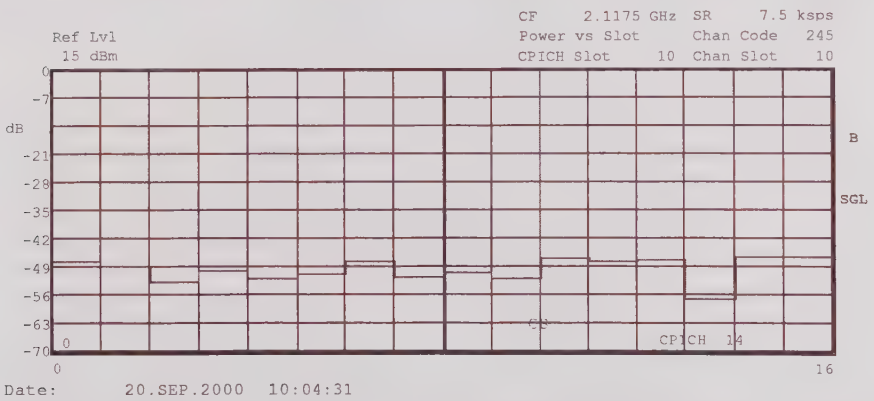


Fig. 6-19 Power versus Slot measurement for a channel without timing offset (unassigned code)

It is not only possible to select a code channel in the CDP diagram, but also to mark a slot in the power-versus-slot diagram. Marking is done by entering the CPICH slot number (see *SELECT CPICH SLOT* softkey) and the selected slot is marked in red. The red marking is always on the starting point of a slot and can be varied only with the slot spacing (see vertical line CS in the figures above).

Modifying a slot number has the following effects:

- The CDP diagram in the upper half of the display is updated referred to the entered CPICH slot number.
- Starting from the CPICH slot, all dependent results are calculated for the actual slot of the selected channel. The relevant graphics are updated.

IEC/IEEE-bus command: `:CALCulate2:FEED "XTIM:CDP:PVSLot"`

The *RESULT SUMMARY* softkey selects the numerical display of all results. The display is subdivided as follows:

```
                                        CF     2.1175 GHz  SR      30 ksps
Ref Lvl                                 Result Summary     Chan Code    27
 10 dBm                                 CPICH Slot    10   Chan Slot     1
```

RESULT SUMMARY

GLOBAL RESULTS				
Total PWR	-1.73 dBm	Carr Freq Err	68.83 mHz	B
Chip Rate Err	-0.04 ppm	Trg to Frame	-444.50 µs	
IQ Offset	0.00 %	IQ Imbalance	0.57 %	
Composite EVM	2.63 % rms	Pk Code Dom Err	-53.57 dB rms	SGL
CPICH Slot Number	10		(7.5 ksps)	
CHANNEL RESULTS				
Symb Rate	30 ksps	Timing Offset	24832 Chips	
Channel Code	27	Chan Slot Number	1	
Chan Pow rel.	-4.01 dB	Chan Pow abs.	-15.61 dBm	
Symbol EVM	0.99 % rms	Symbol EVM	2.09 % Pk	

Fig. 6-20 Result Summary

The upper part contains the results relating to the total signal:

Total PWR: Outputs the total signal power (average power of total evaluated WCDMA frame).

Carr Freq Err: Outputs the frequency error referred to the center frequency of the analyzer. The absolute frequency error is the sum of the analyzer and DUT frequency error.
Differences of more than 1 kHz between transmitter and receiver frequency impair the synchronization of the CDP measurement. For this reason, the transmitter and receiver should be synchronized (see chapter Getting Started).

Chip Rate Err: Outputs the chip rate error (3.84 Mcps) in ppm
As a result of a high chip rate error symbol errors arise and the CDP measurement is possibly not synchronized to the WCDMA signal. The result is valid even if the synchronization of analyzer and W-CDMA signal failed.

Trg to Frame: This result outputs the timing offset from the beginning of the recorded signal section to the start of the analyzed WCDMA frame. In the case of triggered data collection, this timing offset is identical with the timing offset of frame trigger (+ trigger offset) – frame start. In the case of failure of the synchronization of analyzer and W-CDMA signal, the value of Trg to Frame is not significant.

IQ Offset: DC offset of signals in %

IQ Imbalance: IQ imbalance of signal in %

Composite EVM: The composite EVM is the difference between the test signal and the ideal reference signal (see *COMPOSITE EVM* softkey). The rms average (of the analyzed frame) of the measurement results for each slot is given in the RESULT SUMMARY.

Peak Code Dom Err:
The *PEAK CODE DOMAIN ERROR* measurement specifies a projection of the difference between the test signal and the ideal reference signal onto the selected spreading factor (see *PEAK CODE DOMAIN ERR* and *SELECT PCDE SF* softkeys). The average (of the analyzed frame) of the measurement results for each slot is indicated in the *RESULT SUMMARY* as an overview. The spreading factor onto which projection is made is shown below the measurement result.

CPICH Slot: Outputs the number of the CPICH slot at which the measurement is performed (see *SELECT CPICH SLOT* softkey).

The results of measurements on the selected channel (red in the diagram) are displayed in the lower part of the RESULT SUMMARY.

Symb Rate: Symbol rate at which the channel is transmitted.

Timing Offset: Offset between the start of the first slot in the channel and the start of the analyzed WCDMA frame.

Channel Code: Number of the spreading code of the selected channel .

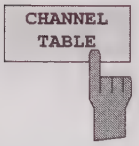
Chan Slot Number:
The CHAN SLOT NUMBER is obtained by combining the value of the SELECT CPICH SLOT softkey and the channel's timing offset.

Chan Pow rel. / abs.:
Channel relative (referred to CPICH) and absolute.

Error Vector Mag Pk / rms:
Peak or average of the results of the error vector magnitude measurement (see SYMBOL EVM softkey).

IEC/IEEE-bus command:

```
:CALCulate2:FEED "XTIM:CDP:ERR:SUMM"
:CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower:RESult?
        PTOTal | FERRor | TFRame | TOFFset | MACCuracy |
        PCDerror | EVMRms | EVMPeak | CERRor | CSLot |
        SRATe | CHANnel | CDPabsolute | CDPRelative |
        IQOFfset | IQIMbalance
```



The *CHANNEL TABLE* softkey selects the display of the channel assignment table. The channel assignment table can contain a maximum of 512 entries, corresponding to the 512 assignable codes of the class with spreading factor 512.

The upper part of the table indicates the channels that have to be present in the signal to be analyzed. The channel power of the CPICH and PCCPCH is specified. The power of the PSCH and SSCH channels is not determined and therefore the associated fields are empty. If the channel table in *CODE CHAN PREDEFINED* mode contains the special channel PICH, this channel is also listed in the upper part of the table.

The lower part of the table indicates the data channels (DPCH) contained in the signal. The channels are in descending order according to symbol rates and within a symbol rate in ascending order according to the channel numbers. Therefore, the unassigned codes are always at the end of the table.

Ref Lvl
10 dBm

CF 2.1175 GHz SR 30 ksps
Channel Table Chan Code 27
CPICH Slot 10 Chan Slot 1

CHANNEL TABLE

A

Type	Symb R.	Code#	Status	TFCI	PilotL	PWR ABS	PWR REL	T Offs
CPICH	15 ksps	0	active	---	--	-11.60	0.00	---
PSCH	15 ksps	---	active	---	--	-.--	-.--	---
SSCH	15 ksps	---	active	---	--	-.--	-.--	---
PCCPCH	15 ksps	1	active	---	--	-11.59	0.00	---
DPCH	30 ksps	17	active	OFF	8	-15.60	-4.00	13312
DPCH	30 ksps	20	active	OFF	8	-15.56	-3.97	26368
DPCH	30 ksps	23	active	OFF	8	-16.56	-4.96	11520
DPCH	30 ksps	27	active	OFF	8	-15.61	-4.01	24832
DPCH	30 ksps	31	active	OFF	8	-18.57	-6.97	36608
DPCH	30 ksps	35	active	OFF	8	-17.59	-5.99	14336
DPCH	30 ksps	38	active	OFF	8	-15.58	-3.98	28672

SGL

Fig. 6-21 Channel Table

The following parameters of these channels are determined by the CDP measurement:

Symbol Rate: Symbol rate at which the channel is transmitted (7.5 ksps to 960 ksps).

Code #: Number of channel spreading code (0 to [spreading factor 1])

Status: Status display. Since the active data channels are automatically searched for by the CDP measurement, each channel is in the active state.

TFCI: Indication of whether or not the data channel uses TFCI symbols.

PWR ABS / PWR REL: Indication of the absolute and relative channel power (referred to the CPICH or the total power of the signal).

T Offs: Timing offset. Offset between the start of the first slot of the channel and the start of the analyzed WCDMA frame.

In *CODE CHAN AUTOSEARCH MODE*, a data channel is considered to be active if the required pilot symbols (see 3GPP specification)are at the end of each slot. In addition, the channel should have a minimum power (see *INACT CHAN THRESHOLD* softkey). In *CODE CHAN PREDEFINED* mode, all channels that are included in the user defined channel table are marked as active.

IEC/IEEE-bus command: `:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABle"`

The *SYMBOL CONST DIAG* softkey selects the display of symbol constellation diagram .
The symbols are displayed for the selected channel (red marking in the CDP diagram) and the selected slot (red marking in the power-versus-slot diagram).

It is possible to display the constellation diagram for unassigned codes (red marking in the CDP diagram on a code represented in blue), but the results are not meaningful, as the unassigned code channel does not contain data.

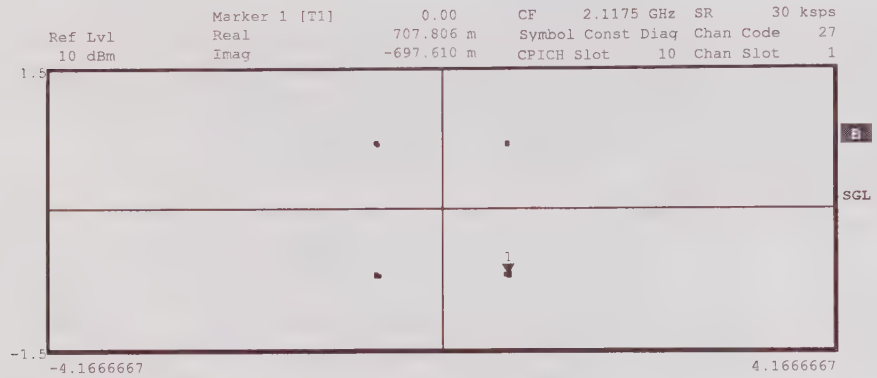
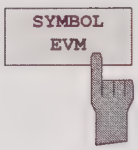


Fig. 6-22 Symbol Constellation Diagram

IEC/IEEE-bus command: `:CALCulate2:FEED "XTIM:CDP:SYMB:CONS"`



The *SYMBOL EVM* softkey activates the symbol error vector magnitude display. The EVM is displayed for the selected channel (red marking in the CDP diagram) and the selected slot (red marking in the power-versus-slot diagram).

It is possible to display the symbol error vector magnitude for unassigned codes (red marking in the CDP diagram on a code represented in blue), but the results are not valid.

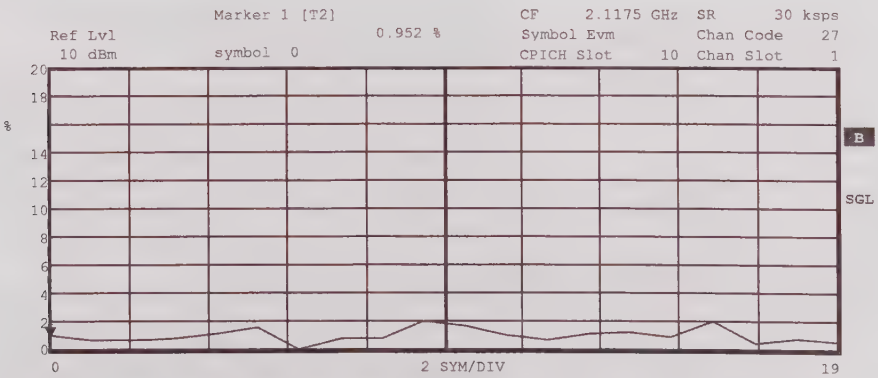


Fig. 6-23 Error Vector Magnitude for the selected slot of the selected channel

IEC/IEEE-bus command: `:CALCulate2:FEED "XTIM:CDP:SYMB:EVM"`

The *BITSTREAM* softkey activates the bitstream display.
The decided bits are displayed for the selected channel (red marking in the CDP diagram) and the selected slot (red marking in the power-versus-slot diagram).

Depending on the channel type and the symbol rate at which the channel is transmitted, specific symbols can be "switched off" in a slot, i.e. power 0 is transmitted instead of these symbols. The results of the bit decision are invalid for such symbols. Such invalid bits are marked by "x" in the diagram.

While it is possible to display the bitstream for unused codes (red marking in the CDP diagramm at a code displayed in blue), the missing data means that the results are not very informative. In this case, "-" is used to indicate that all the bits are invalid.

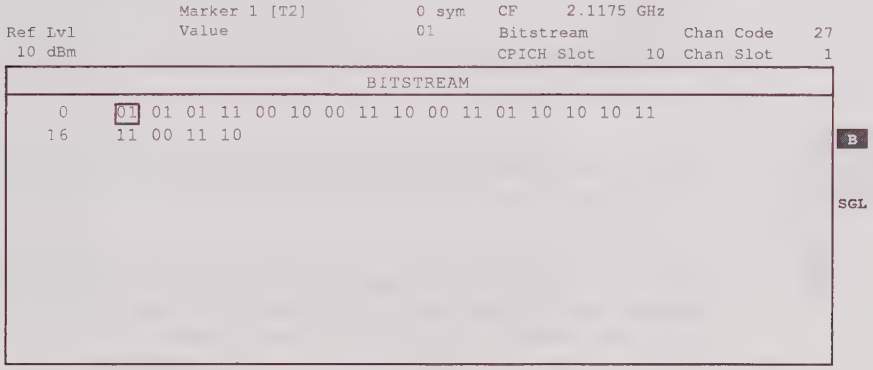


Fig. 6-24 Demodulated bits for the selected slot of the selected channel

IEC/IEEE-bus command: `:CALCulate2:FEED "XTIM:CDP:BSTReam"`

The *SELECT PCDE SF* softkey activates the entry of the class of codes onto which the error vector is to be projected for the *PEAK CODE DOMAIN ERROR* display.
The entry of the spreading factor is only possible for this display mode, it has no effect on any other display mode.

IEC/IEEE-bus command:

```
:[SENSe:]CDPower:SFACtor 4|8|16|32|64|128|256|512
```

The *SELECT CODE NO* softkey activates the selection of a channel for the display modes *CDP PWR RELATIVE/ABSOLUTE*, *CODE PWR ZOOM*, *POWER VS SLOT*, *SYMBOL CONST DIAG*, *SYMBOL EVM*.

The entry is made on the basis of the code class with spreading factor 512. The number of the spreading code which the required channel has at its actual transmission rate has to be converted into spreading factor 512. The entered code correlates with the channel marked in red in the CDP diagram.

If the entered code corresponds to an active channel, the whole associated channel is marked. If it corresponds to a gap between the channels, only the entered code is marked.
If the code number is modified using the rollkey, the red marking changes its position in the diagram only if the code number no longer belongs to the marked channel.

IEC/IEEE-bus command: `:[SENSe:]CDPower:CODE 0 to 511`

The *SELECT CPICH SLOT* softkey activates the selection of the slot number for the display modes *POWER VS SLOT*, *SYMBOL CONST DIAG*, *SYMBOL EVM*.

To avoid ambiguities that may occur due to the permissible timing offsets, the slot number is defined on the basis of the CPICH (i.e. calculated in steps of 2560 chips starting from the beginning of the frame). The desired slot of the selected channel has to be converted according to its timing offset.

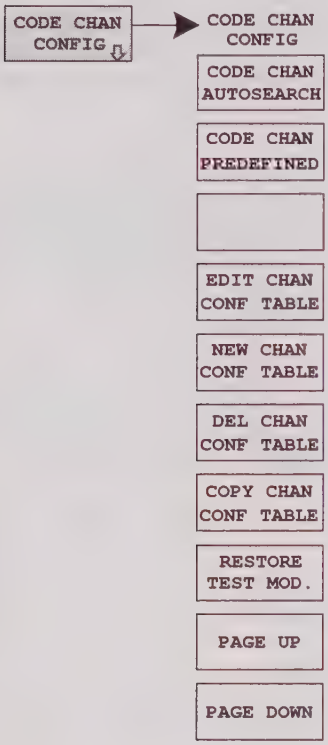
Example:
Slot 0 of the CPICH is set. The selected channel (red marker in the CDP diagram) has a timing offset of 2816 chips, i.e. slot 0 of the channel is delayed by 2816 chips against the frame start. Slot 0 of the CPICH therefore corresponds to slot 1 of the channel.

When the slot number is entered, the red marking in the power-versus-slot diagram changes its position in steps of 2560 chips.

IEC/IEEE-bus command: `:[SENSe:]CDPower:SLOT 0 to 14`

Measurement Configuration

CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE CHAN CONFIG sub menu



The *CODE CHAN CONFIG* softkey opens a submenu with different configurations for measurements. In this submenu, predefined channel tables can be selected and edited as a basis for code domain measurements.

When the softkey is selected, a table including the channel tables stored on the measuring instrument's hard disk is opened. The table provides just an overview and a table for the measurement can only be selected after actuating the *CODE CHAN PREDEFINED* softkey.

IEC/IEEE-bus command:

```
:CONFigure:WCDPower[:BTS]:CTABle:CATalog?
```

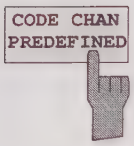
The *CODE CHAN AUTOSEARCH* softkey allows code domain power measurements in the automatic search mode. In this mode, the whole code domain (all permissible symbol rates and channel numbers) is searched for active channels. Detecting an active channel is performed by a comparison with the pilot symbols to be expected after despreading. Only channels with pilot symbols can be detected as active channels. Control channels such as the PICH are not detected by the CDP analysis in this search mode.

Synchronization channels CPICH, PCCPCH, PSCH and SSCH are assumed to be present by the CDP analysis and added to the channel table for each measurement.

The *CODE CHAN AUTOSEARCH* mode is the preset search mode starting the CDP analysis. It is mainly intended for giving the user an overview of the channels contained in the signal. If the signal contains channels that are not detected as being active in the automatic search mode, the CDP analysis can be performed with the channel configurations predefined by the user by switching to the *CODE CHAN PREDEFINED* mode.

IEC/IEEE-bus command:

```
CONFigure:WCDPower[:BTS]:CTABle[:STATe] OFF
```



The *CODE CHAN PREDEFINED* softkey activates the predefined channel table mode. No search for active channels in the code domain is performed in this mode, but the channels contained in a channel table defined prior to the measurement are assumed to be active. The code domain power measurement and all further evaluations are carried out for these channels.

On selecting the softkey, a table containing all channel tables stored in the measuring instrument is opened. The CDP analysis is switched to the predefined channel table. When the next measurement is started, the power is measured according to this mode. The last table of the automatic search mode is first taken as a basis for the measurement. This table is available under the *RECENT* entry.

Switching to one of the predefined channel tables is done by selecting the corresponding table entry and pressing one of the unit keys. From the next measurement onwards, the selected channel table is taken as a basis for the sweep. The selected channel table is marked by a tick.

FSIQK72 comes ready with the following channel tables stored on the measuring instrument:

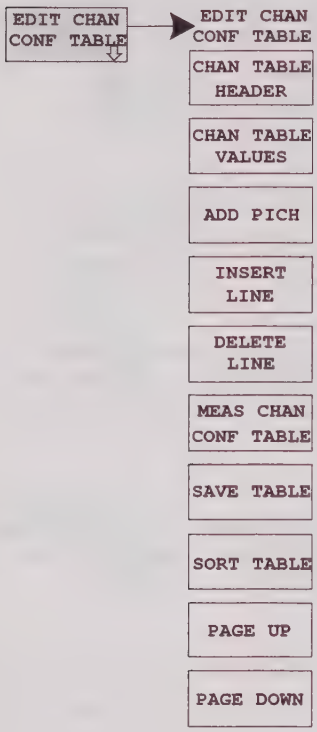
Channel model 1 to 3GPP with 16/32/64 channels
Channel model 2 to 3GPP
Channel model 3 to 3GPP with 16/32 channels
Channel model 4 with CPICH
Channel model 4 to 3GPP without CPICH

The control channel PICH is entered in some channel tables so that the PICH can be correctly detected for a measurement in the *CODE CHAN PREDEFINED* mode and taken into account in the evaluations. The predefined channel tables can be restored in case they have been accidentally overwritten (see softkey *RESTORE TEST MOD.*).

The special channel SCCPCH is also included in some predefined channel tables for the test models. Same as the PICH in the channel table, the SCCPCH channel can be added once. (see softkey *ADD SPECIAL*).

IEC/IEEE-bus command:

```
CONFigure:WCDPower[:BTS]:CTABle[:STATe] ON
CONFigure:WCDPower[:BTS]:CTABle:SELect "3GB_1_32"
```



The *EDIT CHAN CONF TABLE* softkey opens a submenu giving access to the softkeys required for editing the channel table. The channel table is opened simultaneously for editing. The user can modify the channel configuration in the selected channel table

EDIT CHANNEL TABLE

NAME: 3GB_1 16

COMMENT: 3GPP Base Station Test Model 1 16 Channels

SYMBOL RATE [ksps]	CODE #	USE TFCI	TIMING OFFS. [CHIPS]	PILOT BITS	CDP REL. [dB]	STATUS
PICH	16		30720	---	0.0	ACTIVE
CPICH	0			---	0.0	ACTIVE
PCCPCH	1			---	0.0	ACTIVE
SCCPCH 15.0	3	NO	0	8	0.0	ACTIVE
30.0	2	NO	22016	8	0.0	ACTIVE
30.0	11	NO	34304	8	0.0	ACTIVE
30.0	17	NO	13312	8	0.0	ACTIVE
30.0	23	NO	11520	8	0.0	ACTIVE
30.0	31	NO	36608	8	0.0	ACTIVE
30.0	38	NO	28672	8	0.0	ACTIVE
30.0	47	NO	15104	8	0.0	ACTIVE
30.0	55	NO	5888	8	0.0	ACTIVE
30.0	62	NO	256	8	0.0	ACTIVE
30.0	69	NO	22528	8	0.0	ACTIVE
30.0	78	NO	7680	8	0.0	ACTIVE
30.0	85	NO	4608	8	0.0	ACTIVE
30.0	94	NO	7680	8	0.0	ACTIVE
30.0	102	NO	15616	8	0.0	ACTIVE
30.0	113	NO	32768	8	0.0	ACTIVE
30.0	119	NO	36608	8	0.0	ACTIVE

Date: 29.NOV.2001 09:22:24

Fig. 6-25 Table for editing a channel configuration

The user has the possibility of modifying any of the channel tables stored in the instrument. The edited table is not stored automatically on the instrument hard disk but only after the user has activated the *SAVE TABLE* softkey. This prevents inadvertent overwriting of a table (e.g. one of the channel models).

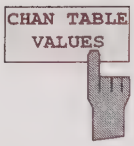
If the user edits the table that is currently taken as a basis for the CDP analysis, the edited table is used for the next measurement immediately after storage. The effects of modifications in the table are therefore visible at once. The edited table is stored on the instrument hard disk only after the user has activated the *SAVE TABLE* softkey.

If the user edits a table that is stored on the instrument hard disk but currently not activated, the modifications are visible after storage (*SAVE TABLE* softkey) and subsequent activation.

If the *SYMBOL RATE* or *CHAN NO* of a channel is modified, a check for code domain conflicts is performed after the entry has been confirmed (unit hardkeys). If a code domain conflict is detected, the associated channels are marked by an asterisk. The user has the possibility of eliminating the code domain conflicts. When a table containing code domain conflicts is used for a CDP analysis, the results are invalid.

The *CHAN TABLE HEADER* softkey enables the user to edit the table header. The table name can be changed to prevent overwriting stored tables. The name of a table may not contain more than 8 characters.

IEC/IEEE command: `:CONFigure:WCDPower[:BTS]:CTABle:NAME "NEW_TAB"`



The *CHAN TABLE VALUES* softkey enables the user to edit the entries in the channel table. The following entries are available for each channel contained in the table (entry is confirmed using the unit hardkeys):

SYMBOL RATE:
symbol rate at which the channel is transmitted. This entry cannot be edited for channels whose symbol rate is defined in the standard (e.g. synchronization channels). In the case of special channels, the channel type is entered instead of the symbol rate.

CHAN NO:
number of the channel in the associated transmission class. The validity of the entered channel number in the selected transmission rate is checked on entry, invalid entries are not permitted.

USE TFCI:
indicates whether the channel contains TCFI symbols. This information is required for determining the slot format of the channel. This entry cannot be edited for channels that contain no TFCI information.

TIMING OFFSET:
timing offset of the channel. The expected timing offset is the channel offset referred to the CPICH, specified in chips. This entry cannot be edited for channels that have no timing offset.

PILOT SYMBOLS:
number of pilot symbols of the channel. This information is required for determining the slot format. This entry cannot be edited for channels that contain no pilot symbols. The entry is made in bits.

CDP REL.:
information about the relative channel power. This entry cannot be edited and is only available for the *RECENT* table, it is used for detecting low-power channels.

STATUS:
channel status (active/inactive). Modifying the channel status blanks out a channel entered in the table from the CDP analysis without the user having to clear the associated entry from the table. Only channels with an active channel status are used for the CDP analysis.

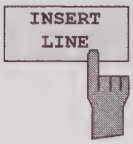
IEC/IEEE commands:

```
:CONFigure:WCDPower[:BTS]:CTABle:DATA
     8,0,0,0,0,0,1,0.00,8,1,0,0,0,0,1,0.00,7,1,0,256,8,0,
     1,0.00

:CONFigure:WCDPower[:BTS]:CTABle:COMMent "Comment for new
    table"
```

The *ADD SPECIAL* softkey opens a table where the available special channels can be selected. PICH and SCCPCH are available as special channels in the FSIQK72. They are included in the channel tables of the test models. Each of the two channels can be added once to the channel tables.

IEC/IEEE command: included in command `:CONF:WCDP:CTAB:DATA`



The *INSERT LINE* softkey inserts a new entry into the table. The entries can be made in any order. A channel is taken into account in the CDP analysis only if all required entries are available in the list.

IEC/IEEE command: --

The *DELETE LINE* softkey deletes the marked line from the table.
The *MEAS CHAN CONF TABLE* softkey starts a measurement in the *CODE CHAN AUTOSEARCH* mode. The measurement results are entered in the opened channel table.

IEC/IEEE command: --

The *MEAS CHAN CONF TABLE* softkey starts a measurement in the *CODE CHAN AUTOSEARCH* mode. The measurement results are entered in the opened channel table. The softkey is only available in *CODE CHANNEL AUTOSEARCH* mode.

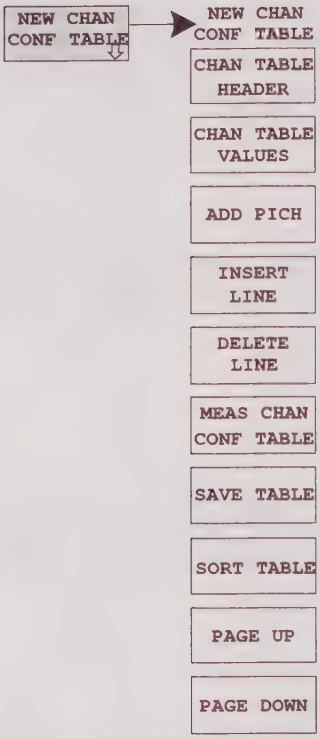
IEC/IEEE command: --

The *SAVE TABLE* softkey saves the table under the specified name.
Caution: Editing the channel models and storing them under the initial name overwrites the models.

IEC/IEEE command: -- (automatically executed in remote control)

The *SORT TABLE* softkey sorts the table according to symbol rates in descending order and within a symbol rate according to channel numbers in ascending order.

IEC/IEEE command: --



The *NEW CHAN CONF TABLE* softkey opens a submenu, which is identical to the submenu described for the *EDIT CHAN CONF TABLE* softkey. In contrast to *EDIT CHAN CONF TABLE, NEW CHAN CONF TABLE* only adds the synchronization channels to the table for, the table name is still not defined:

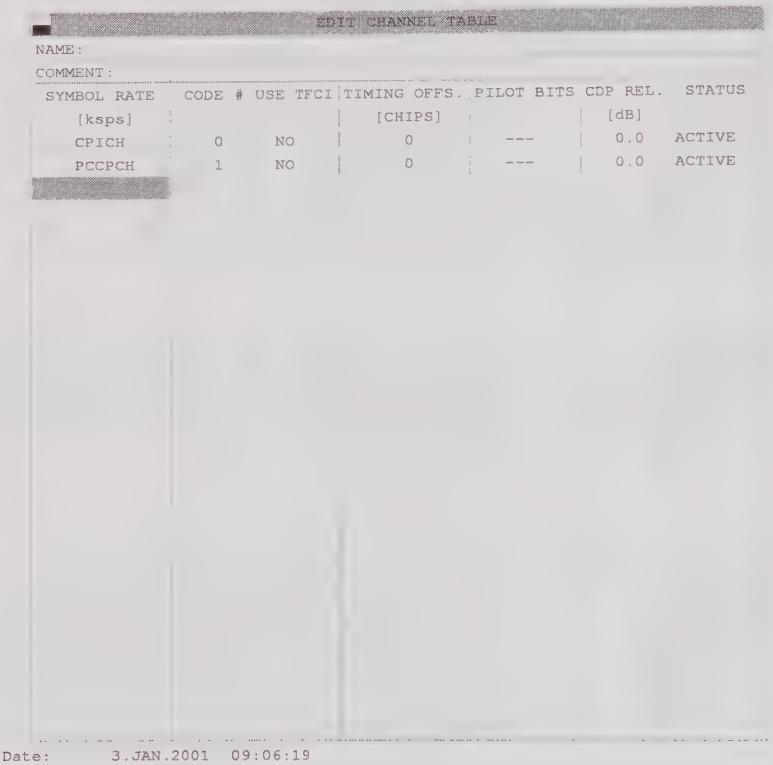

EDIT CHANNEL TABLE
NAME:
COMMENT:
SYMBOL RATE | CODE # | USE TFCI | TIMING OFFS. | PILOT BITS | CDP REL. | STATUS
[ksps] | | | [CHIPS] | | [dB] |
CPICH | 0 | NO | 0 | --- | 0.0 | ACTIVE
PCCPCH | 1 | NO | 0 | --- | 0.0 | ACTIVE
Date: 3.JAN.2001 09:06:19

Fig. 6-26 Table for creating a new channel configuration

The *DEL CHAN CONF TABLE* softkey deletes the selected table stored in the measuring instrument. The active table cannot be deleted in the *CODE CHAN PREDEFINED* mode.

IEC/IEEE command:

```
:CONFigure:WCDPower[:BTS]:CTABle:DELete
```

The *COPY CHAN CONF TABLE* softkey copies the selected table and stores it under a new name.

IEC/IEEE command:

```
:CONFigure:WCDPower[:BTS]:CTABle:COPY "CTAB2"
```

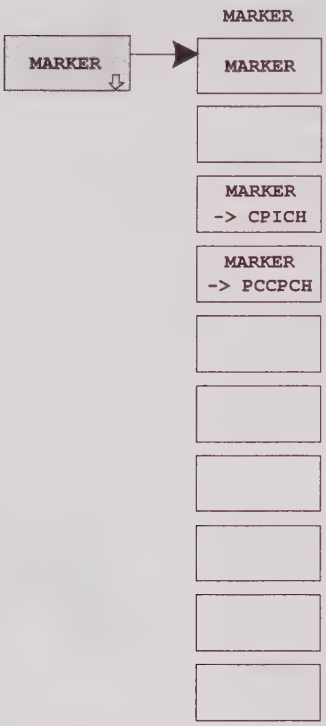
The *RESTORE TEST MOD.* softkey restores the default state when one of the predefined test models has been accidentially overwritten. The channel tables of the 3GPP test models in the current directory are overwritten with the default tables preset upon instrument delivery.

IEC/IEEE command:

```
:CONFigure:WCDPower[:BTS]:CTABle:RESTore
```

MARKER Functions

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER*



The *MARKER* softkey opens a submenu with the marker settings.

Markers are not available in the tabulated display modes *RESULT SUMMARY* and *CHANNEL TABLE.*

The parameters concerning an activated marker are output at the top of the diagram:

```
Marker 1 [T1]
                    -5.00 dB
slot 10 SR  30 ksps chan  23
```

Fig. 6-27 Parameters of the marker info field

Besides the channel power, which is displayed relative to the value specified with *POWER REF TOT/CPICH*, the parameters are:

Slot: Slot number of the channel (unassigned codes have a timing offset of 0 chip referred to beginning of the frame)

SR: Symbol rate of the channel (for unassigned codes 7.5 ksps)

Chan: Number of the spreading code of the channel

The *MARKER* softkey switches the marker on or off.

IEC/IEEE-bus commands:

```
:CALCulate<1|2>:MARKer<1>:STATe ON
:CALCulate<1|2>:MARKer<1>:X <channel_number>
:CALCulate<1|2>:MARKer<1>:Y?
```

The *MARKER -> CPICH* sets the marker to the common pilot channel (code number 0 for spreading factor 256; corresponds to displayed code numbers 0 and 1 of the x-axis).

IEC/IEEE-bus commands:

```
:CALCulate<1|2>:MARKer<1>:FUNCtion:CPICh
:CALCulate<1|2>:MARKer<1>:Y?
```

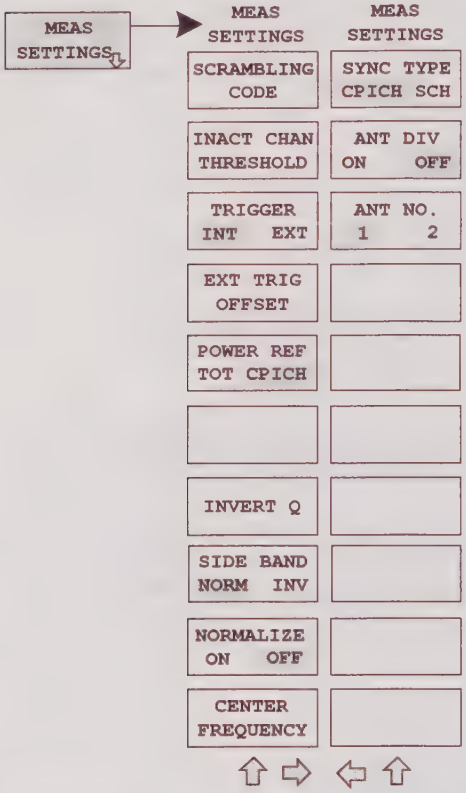
The *MARKER -> PCCPCH* sets the marker to the primary common control physical channel (code number 1 for spreading factor 256; corresponds to displayed code numbers 2 and 3 of the x-axis).

IEC/IEEE-bus commands:

```
:CALCulate<1|2>:MARKer<1>:FUNCtion:PCCPch
:CALCulate<1|2>:MARKer<1>:Y?
```

Configuration of CDP Measurement – MEAS SETTINGS

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER*



The *MEAS SETTINGS* softkey opens a submenu with setting parameters for the CDP measurement.

The *SCRAMBLING CODE* softkey opens a window for entering the scrambling code. The scrambling code is output in hex format.

The entered scrambling code has to coincide with that of the signal. Otherwise a CDP measurement of the signal is not possible.

IEC/IEEE-bus command: `:[SENSe:]CDPower:LCODe[:VALue] #H2`

The *INACT CHAN THRESH* softkey activates the entry of the minimum power which a single channel should have as compared to the total signal in order to be considered an active channel.

Channels which are below the specified threshold are considered to be not active irrespective of whether they contain pilot symbols or not. Channels that are not active appear in blue colour in the CDP diagram.

The two measurements *COMPOSITE EVM* and *PEAK CODE DOMAIN ERR,* specified as measurements on the total signal, are performed with the aid of the list of active channels. These two measurements are falsified whenever active channels are recognized as not active (see above example) or if unassigned codes get the status "assigned channel". *INACT CHAN THRESHOLD* is therefore used to influence the results of the two measurements.

The default value is -20 dB which allows all channels of signals like the 3 GPP test signals to be detected in the CDP analysis. If not all channels in the signal are automatically detected, *INACT CHAN THRES* has to be decremented.

IEC/IEEE-bus command:

```
:[SENSe:]CDPower:ICTReshold -50dB to +10dB
```

The *TRIGGER INT EXT* softkey switches between internal (*FREE RUN*) and external triggering.

For internal triggering, at the beginning of the measurement a section (approx. 20 ms) of the signal, which must contain at least one frame of the WCDMA signal, is recorded and analyzed at a moment which cannot be determined by the user. The start of the next complete WCDMA frame is searched for in the recorded signal section and the signal is measured from this point.

In case of external triggering, FSIQK72 expects a trigger at the beginning of the WCDMA frame (frame trigger). There is no search for the beginning of the frame in the recorded signal section. The start of the WCDMA frame is only searched for within the first 2560 chips after the trigger event.

Because of the power control which according to the 3GPP standard is performed for always one slot at the beginning of the pilot symbols of the previous slot (power group), the data record must contain 1024 chips for CDP analysis before the start of a WCDMA frame. Because of the chips required before the start, the CDP analysis cannot be started at slot 0 of a WCDMA frame when the trigger offset is 0 in the case of external triggering. Slot 1 of the next frame is selected instead as a start slot for the analysis. When a negative trigger offset of –266.67 µs is entered (default setting of FSIQK72), the CDP analysis starts with slot 0 of the next WCDMA frame. The start slot of the analysis is displayed as the first slot in the *COMPOSITE EVM* and *PEAK CODE DOMAIN ERROR* diagrams.

For external triggering the trigger output of the base station has to be connected to the FSIQ trigger input at the rear panel of the instrument.

Since with internal triggering the start of the next complete WCDMA frame is located in the middle of the recorded signal section (after approx. 10 ms) in the worst case, an external frame trigger reduces the search time for the frame start and consequently the computing time for the overall measurement.

IEC/IEEE-bus command:

```
:TRIGger[:SEQuence]:SOURce IMMediate|EXTernal
```

The *EXT TRG OFFSET* softkey activates the entry of the offset for external triggering (step width 40 ns).
The trigger offset can compensate for the shift of the frame trigger at the actual start of a frame. In the *RESULT DISPLAY* mode, the interval between the trigger event and the start of the WCDMA frame is indicated under "Trg to Frame". An offset of the trigger event influences the interval specified there.

Because of the power control specified by the 3GPP standard, the CDP analysis requires at least 1024 chips before the start of the WCDMA frame. This corresponds to a trigger offset of -266.67 µs. This trigger offset permitting the display of *COMPOSITE EVM* and *PEAK CODE DOMAIN ERROR* to be started at slot 0 is set as the softkey default value.

If the trigger offset is set inadequately, the measurement may not be able to detect the start of a WCDMA frame in the search range. In this case, the measurement results are invalid and the code power of each channel is displayed in blue with almost the same level.

A modification of the trigger offset can influence the search range of FSIQK72 and thus secure the feasibility of the measurement.

IEC/IEEE-bus command: `:TRIGger:SEQuence:HOLDoff <num_value>`

The *POWER REF TOT / CPICH* softkey determines the reference power for the relative power displays:

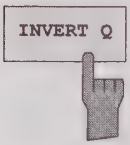
TOT All the relative powers (display modes *CDP RELATIVE* and *POWER VS SLOT*) are referred slot by slot to the total signal power in the slot involved.

CPICH The reference power is that of the CPICH in the relevant slot.

The default setting of the softkey is *CPICH*.

Since 3GPP specifies a slot-specific power control for every channel, the total power of the signal will change from slot to slot in accordance with the power control of the individual channels. As a result, with activated power control and reference to the total power of the signal, a relative CDP display versus the slot number (*POWER VS SLOT*) does not necessarily represent the power control of the selected channel.
Example:
If the signal (theoretically) contains only one data channel whose power is controlled, and if the power is referred to the total power of the signal (which is formed only by the contribution of this data channel), a straight line appears in the *POWER VS SLOT* diagram instead of the expected power staircase. Consequently, the reference value *TOT* of the relative displays is informative only if the signal does not contain power control.
By contrast, the *CPICH* setting also reflects the exact characteristic of the power versus the slot number in a selected channel for signals with power control. Since the CPICH is never power controlled, this yields the same reference value in every slot.

IEC/IEEE-bus command: `:[SENSe:]CDPower:PREFerence TOTal|CPICh`



The *INVERT Q* softkey inverts the sign of the Q component of the signal. The softkey is deactivated in the default setting.

IEC/IEEE-bus command: `[SENSe:]CDPower:QINVert OFF`

The *SIDE BAND NORM / INV* softkey is used to perform the measurement both in the normal (NORM) and inverted position (INV).

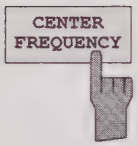
NORM The normal position allows the measurement of RF signals from the base station.

INV The inverted position is useful for measurements on IF modules or components in case of spectral inversion (default setting).

IEC/IEEE-bus command: `:[SENSe:]CDPower:SBANd NORMal|INVers`

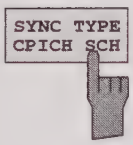
The *NORMALIZE ON / OFF* softkey eliminates the DC offset of the signal. Default setting is OFF.

IEC/IEEE-bus command : `[SENSe:]CDPower:NORMalize OFF`



The *CENTER FREQUENCY* activates the input of the center frequency of the WCDMA signal.

IEC/IEEE-bus command: `:[SENSe:]FREQuency:CENTer 870.03 MHz`



The *SYNC TYPE CPICH/SCH* softkey selects the type of synchronization:

CPICH Synchronization to CPICH (default). For this kind of synchronization the CPICH must be included in the transmitted signal.

SCH Synchronization without CPICH. This kind of synchronization is intended for test model 4, which is defined with or without DPICH.

IEC/IEEE-bus command:

`:[SENSe<1|2>:]CDPower:STYPe CPICh | SCHannel`

The *ANT DIV ON/OFF* softkey switches the antenna diversity mode on or off.

OFF Antenna diversity mode switched off.

1 | 2 According to 3 GPP, the pilot symbols of the channels are different for depending on the antenna used. The CPICH symbols are different and the synchronization channels are transmitted alternately in every second slot.

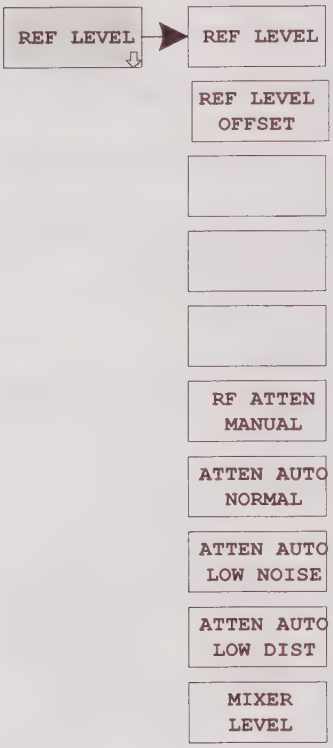
IEC/IEEE-bus command `:[SENSe<1|2>:]CDPower:ANTenna OFF|1|2`

The *ANT NO. 1/2* softkey selects the antenna of the diversity path. The softkey is only available when *ANTENNA DIVERSITY* is *ON*. Antenna No. 1 is the default setting

IEC/IEEE-bus command: `:[SENSe<1|2>:]CDPower:ANTenna OFF|1|2`

Level Settings – REV LEVEL

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER*



The *REF LEVEL* softkey opens a submenu for level setting.

The softkeys and their function are identical to the *REF LEVEL* menu in the basic unit and are described in the operating manual of the basic instrument.

Automatic Adaptation to Input Level - LEVEL AUTO ADJUST

Submenu: *CONFIGURATION- MODE – 3GPP BTS ANALYZER – LEVEL AUTO ADJUST*

The *LEVEL AUTO ADJUST* softkey is used for automatically setting the RF attenuation and reference level to the level of the applied signal. Manual re-adjustment is permissible with the *REF LEVEL* softkey.

The instrument is to be switched to the *ATTEN MANUAL* mode so as to set the RF attenuation and reference level to optimum values independently of each other. This mode is maintained after changing from code-domain power measurements to the spectrum analyzer or vector signal analyzer mode.

IEC/IEEE-bus command sequence:

```
*RST
:INSTrument[:SELect] BWCDpower
:INITiate:CONTinuous OFF
:[SENSe:]CDPower:LEVel:ADJust; *OPC?
:INITiate[IMMediate]; *OPC?
:TRACe? TRACE1
```

Automatic Setting of CDP Measurement Mode - CDP AUTO ADJUST

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER*

The *CDP AUTO ADJUST* softkey automatically adapts the settings of the CDP measurement in such a way that a valid measurement on the signal is possible with high probability. For this purpose

- the following measurement parameters are set to predefined values:

Trigger:	FREE RUN
Marker / delta marker:	OFF
Code number:	0
Slot number:	0
Symbol rate:	15 ksps (referred to CPICH)

- RF attenuation and reference level are set using *LEVEL AUTO ADJUST*
- a *SINGLE SWEEP* in *CODE CHAN AUTOSEARCH* is carried out.

With these settings, the CDP measurement can be performed with high probability, provided a valid WCDMA signal to 3GPP is applied to the RF input of analyzer. The parameters *CENTER FREQUENCY*, *SCRAMBLING CODE* as well as an external reference for the measurement have to be manually adapted to the signal.

IEC/IEEE-bus command: `:[SENSe:]CDPower:PRESet`

Trace Settings - TRACE Key Group

The *TRACE MATH* and *DETECTOR* settings are not available in the *TRACE* menu. The remaining softkeys are identical to those of the basic unit and are described in the FSIQ operating manual. The *DISPLAY MODE CDP* softkey opens the *RESULT DISPLAY* submenu of the CDP measurement mode.

The TRACE side menu contains the softkeys for ASCII trace export. Using this softkeys, traces can be stored in files with ASCII format. This way, traces are available for mathematical processing in corresponding programs. These softkeys are used to store traces in a file so that the traces are available in a form that can be processed with mathematical programs.

The *ASCII EXPORT* softkey stores the corresponding trace in a file with ASCII format. The export function can be configured in the *ASCII CONFIG* submenu.

The *ASCII CONFIG* softkey calls a submenu for various settings for the *TRACE ASCII EXPORT* function.

The *EDIT PATH* softkey defines the directory in which the file is to be stored.

IEC/IEEE-bus command --

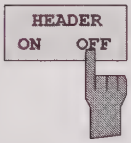
The *DECIM SEP* softkey selects the decimal separator for the ASCII file. The choice is '.' (decimal point) or ',' (comma).
This means that the decimal separator used in various language versions of evaluation programs (e.g. MS-Excel) can be selected so that the packages are supported. .

IEC/IEEE-bus command
`:FORMat:DEXPort:DSEParator POINt|COMMa`

The *APPEND NEW* softkey defines whether output data are to be written to an existing file or a new file.

- With *APPEND,* the data are added to an existing file.
- With *NEW,* either a new file is generated or an existing file is overwritten by storage of the data.

IEC/IEEE-bus command `:FORMat:DEXPort:APPend ON | OFF`



The *HEADER ON/OFF* softkey defines whether important instrument settings should be stored at the beginning of the file. The general device settings entered in the file header allow test results to be reproduced. A file header may impair data processing by mathematical programs.

IEC/IEEE-bus command `:FORMat:DEXPort:HEADer ON|OFF`

The *ASCII COMMENT* softkey activates the entry of commentary concerning the current ASCII data set. A total of 60 characters are available for this purpose.

IEC\IEEE bus command `:FORMat:DEXPort:COMMent 'string'`

In CDP measurement mode, the *ASCII EXPORT* softkey stores the corresponding trace in a file with ASCII format.

Upon pressing the ASCII EXPORT softkey, a file name can be entered. The default name is TRACE.DAT. Then the measured data of the trace are stored.

IEC/IEEE-bus command `:MMEMory:STORe:TRACe 1..4,<Pfad mit Filenamen>`

Structure of the ASCII file for CDPower measurements and measurements of signal spectrum:

The file consists of the header containing important scaling parameters and a data section containing the trace data. The data of the file header consist of three columns, each separated by a semicolon: parameter name; numeric value; basic unit

The data section starts with the keyword " Trace <n> " (<n> = number of stored trace), followed by the measured data in one or several columns (depending on measurement) which are also separated by a semicolon.
This format can be read in from spreadsheet calculation programs, eg MS-Excel. It is necessary to define ';' as a separator.

1) Format for CDP measurements

	Content of file	Description
File header	Type;FSIQ 7;	Instrument model
	Version;4.10;	Firmware version
	Date;26.Mar 2001;	Date record storage date
	Comment;ASCII file;	Comment
	Mode;CDP;	Instrument operating mode
	Measurement;Code Domain Power;	Display mode (CDP, bitstream, ...)
	Digital Standard;WCDMA 3GPP FWD;	Digital standard (3GPP REV, 3GPP FWD)
	Center Freq;2117500000.000000;Hz;	Center frequency
	Freq Offset;0.000000;Hz;	Frequency offset
	Ref. Level;-6.000000;dBm;	Reference level
	Level Offset;0.000000;dB;	Level offset
	RF Att;10.000000;dB;	Input attenuation
	y per div;2;dB;	Scaling of y axis per division
	Ref Value y-Axis;0;dB;	Scaling of y axis, reference value
	Ref Value Position;100.000000;%;	Scaling of y axis, position of reference value
	Sweep Count;0;	Number of sweeps set
	Spreading Factor;256;	Spreading factor
	Reference Slot;0;	Slot of the reference channel (CPICH)
	Channel Slot;0;	Channel slot
	First Slot;0;	First slot
	Code Number;0;	Code number: 0 to 511
	Scrambling Code;0000H;	Scrambling code: 0000 to 1FFFH
	Scr Type;N/A;	Scrambling type: N/A
	Channel Threshold;-20;	Channel threshold
	Invert Sideband;OFF;	Sideband; ON, OFF;
	Normalize;OFF;	Normalize;ON, OFF;
	Invert Q;OFF;	Invert Q;ON, OFF; N/A
Data section of the file (CDP abs / CDP rel / Channel Table)	Trace 1:	Trace
	Trace Mode;CLR/WRITE;	Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD
	Values;238;	Number of data blocks / measurement values
	8;0;-13.643795;-3.643795;0;0;-;	<CodeClass>;<CodeNumber>;<yabs>;<yrel>;
	7;32;-21.409958;-11.409958;256;8;-;	<TimingOffset>;<PilotLength>;<Mapping>;
	7;33;-23.137810;-13.137810;15360;8;-;	
	7;34;-15.651539;-5.651539;3328;8;-;	in FSIQK72 the mapping value is not relevant, therefore a minus '-" is output
	7;35;-21.930389;-11.930389;32768;8;-;	
	7;36;-18.120872;-8.120872;0;8;-;	
	...	

	Content of file	Description
Data section of the file (Result Summary)	Trace 2:	Trace
	Trace Mode;CLR/WRITE;	Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD
	3.135467;%;	Peak value composite EVM
	-52.303844;dB;	Peak value PCDE
	-9.127991;Hz;	Frequency error (carrier deviation)
	-5.221600;ppm;	Chip rate error
	-7.365761;dBm;	Total power of signal
	-122.502686;ms;	Trigger offset to frame start
	5.236792;%;	Peak value EVM
	2.605927;%;	RMS value EVM
	0.010436;%;	IQ offset
	0.938106;%;	IQ imbalance
	8;	Code class
	0;	Code number
	-2.310928;	Y absolute
	0.000000;	Y relative
	0.000000;	Timing offset
	8;	Pilot length
	-;	Mapping (for FSIQK72: '-')
Data section of the file (Power versus Slot / Peak Code Domain Error / Composite EVM)	TRACE 2:	Trace
	Trace Mode;CLR/WRITE;	Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD
	Values;15;	Number of data blocks / measurement values
	0;16.843128;	<Slot>; <LevelValue>;
	1;0.554786;	
	2;11.818155;	
	3;15.885643;	
	....	
Data section of the file (Symbol Constellation)	TRACE 2:	Trace
	Trace Mode;CLR/WRITE;	Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD
	Values;10;	Number of data blocks / measurement values
	-0.293423;1.388842;	<LevelValue Real>;<LevelValue Imag>;
	0.038587;-0.735293;	
	0.961711;-1.217144;	
	2.015055;-0.696284;	
	....	
Data section of the file (Bitstream)	TRACE 2:	Trace
	Trace Mode;CLR/WRITE;	Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD
	Values;160;	Number of data blocks / measurement values
	0;1;0;1;1;1;0;1;1;0;	<Symbol>;
	0;0;1;1;0;0;1;0;1;0;	
	0;1;9;9;9;9;9;9;9;9;	
	1;0;1;0;0;1;1;0;0;0;	
	....	

	Content of file	Description
Data section of the file (Symbol EVM)	TRACE 2:	Trace
	Trace Mode;CLR/WRITE;	Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD
	Values;10;	Number of data blocks / measurement values
	5.288429;	<LevelValue>;
	1.950043;	
	3.740749;	
	2.073324;	
	....	

2) Format for CCDF measurements

	Content of file	Description
File header	Type;FSIQ 7;	Instrument model
	Version;4.10 ;	Firmware version
	Date;26.Mar 2001;	Date record storage date
	Comment;ASCII-File;	Comment
	Mode;CCDF;	Instrument operating mode
	Center Freq;2117500000.000000;Hz	Center frequency
	Freq Offset;0.000000;Hz	Frequency offset
	x-Axis;LIN;	Scaling of x axis linear (LIN) or logarithmic (LOG)
	Ref. Level;-20.000000;dBm	Reference level
	Level Offset;0.000000;dBm	Level offset
	RF Att;10.000000;dB	Input attenuation
	RBW;10000000.000000;Hz	Resolution bandwidth
	SWT;0.074000;s	Sweep time
	Detector;AUTOPEAK;	Detector set: AUTOPEAK, MAXPEAK, MINPEAK, AVERAGE, RMS, SAMPLE
	Sweep Count;0;	Number of sweeps set
	Sample Count;0;	Number of samples set
	y max;0;	Maximium level
	y min;0;	Minimium level
	Averaging;OFF;	Averaging ON/OFF
Data section of the file	TRACE 1:	Trace
	Trace Mode;CLR/WRITE;	Unit of x values: Mean Pwr + ... dB;
	x-Unit;dB;	Number of measurement points
	Values;500;	<x value>, <y1>, <y2>
	0.000000;-12.450729;-106.249130	<y2> being available only with AUTOPEAK detector and containing in this case the smaller of the two measured values for a measurement point.
	26052104.208417;-74.768776;-108.954018	
	52104208.416834;-74.841995;-107.017891	
	78156312.625251;-74.569473;-103.686615	
	...	

3) Format for Spectrum Emmission Mask measurements

	Content of file	Description
File header	Type;FSIQ 7	Instrument model
	Version;4.10;	Firmware version
	Date;26.Mar 2001;	Date record storage date
	Comment;ASCII-File;	Comment
	Mode;SEM;	Instrument operating mode
	Start;0.000000;Hz	Start/stop of the display range. Unit: Hz for span > 0, s for span = 0,
	Stop;7000000000.000000;Hz	
	Center Freq;2117500000.000000;Hz	Center frequency
	Span;7000000000.000000;Hz	Frequency range (0 Hz for zero span)
	Freq Offset;0.000000;Hz	Frequency offset
	x-Axis;LIN;	Scaling of x axis linear (LIN) or logarithmic (LOG)
	y-Axis;LOG;	Scaling of y axis linear (LIN) or logarithmic (LOG)
	Level Range;100.000000;dB	Display range in y direction. Unit: dB for x axis LOG, % for x axis LIN
	Ref. Level;-20.000000;dBm	Reference level
	Level Offset;0.000000;dBm	Level offset
	Max. Level;-20.000000;dBm	Maximium level
	RF Att;10.000000;dB	Input attenuation
	RBW;STD;	Resolution bandwidth
	VBW;3000000.000000;Hz	Video bandwidth
	SWT;0.074000;s	Sweep time
	Detector;RMS;	Detector set: AUTOPEAK, MAXPEAK, MINPEAK, AVERAGE, RMS, SAMPLE
	Sweep Count;0;	Number of sweeps set
	Channel Power; 0;	Channel power
	Limit Line; P>31;	Selected limit line
Data section of the file	TRACE 1:	Trace
	Trace Mode;CLR/WRITE;	Unit of x values: Hz for span > 0; s for span = 0; dBm/dB for statistics measurements
	x-Unit;Hz;	Unit of y values: dB*/V/A/W depending on the selected unit for y axis LOG or % for y axis LIN
	y-Unit;dBm;	Number of measurement points
	Values;500;	Measured values: <x value>, <y1>, <y2>
	6487500000.000000;-90.754356;	<y2> being available only with AUTOPEAK detector and containing in this case the smaller of the two measured values for a measurement point.
	6487550100.200400;-90.956367;	
	6487600200.400802;-90.655090;	
	6487650300.601202;-91.537399;	
	...	

Overview of Other Menus

SYSTEM Key Group

The *PRESET; CAL* and *INFO* menus in the code domain measurement mode are identical to the corresponding menus in the basic unit and are described in the FSIQ operating manual.

The parameters marked with grey are not available in the *DISPLAY* menu. The screen display is set to *SPLIT SCREEN* in the code domain measurement mode. The remaining softkeys are identical to those of the basic unit and are described in the FSIQ operating manual.

CONFIGURATION Key Group

The *MODE* menu enables selection of the mode. The analyzer, vector analyzer and tracking generator modes are described in the operating manual for the FSIQ basic unit. The code domain measurement mode is described in the present manual.

The *SETUP* menu in the code domain measurement mode is identical to the corresponding menu in the basic unit and is described in the FSIQ operating manual.

FREQUENCY Key Group

In the *CENTER* menu, the center frequency can be set for synchronization with the DUT and a frequency offset entered.

The *SPAN, START* and *STOP* keys have no function in the code domain measurement mode.

LEVEL Key Group, INPUT Key

The *REF, RANGE* and *INPUT* menus in the code domain measurement mode are identical to the corresponding menus in the basic unit and are described in the FSIQ operating manual.

MARKER Key Group

The *NORMAL* menu in the code domain measurement mode is identical to the *CONFIGURATION MODE – 3GPP BTS ANALYZER – CODE DOM POWER* submenu.

The *DELTA* menu in the code domain measurement mode is identical to the corresponding menu in the vector analyzer mode and is described in the FSIQ operating manual.

The *SEARCH* and *MKR →* keys have no function in the code domain measurement mode.

LINES Key Group

The *LIMIT LINES* and *D-LINES* keys have no function in the code domain measurement mode.

SWEEP Key Group

The softkeys *FREE RUN, EXTERN, TRIGGER OFFSET* and *SLOPE POS/NEG* are available in the *TRIGGER* menu.

In the SWEEP menu only the parameters *SINGLE SWEEP* and *CONTINUOUS SWEEP* are available.

The *COUPLING* key has no function in the code domain measurement mode.

HCOPY and MEMORY Key Group

The *SETTINGS, RECALL* and *CONFIG* menus in the code-domain measurement mode are identical to the corresponding menus in the basic unit and are described in the FSIQ operating manual.

The *SAVE* menu offers the possibility to store the WCDMA channel tables. To this end, selection "WCDMA channel table" is included in the *ITEMS TO SAVE* selection list. The corresponding data set file has the extension *.ctb.

7 Remote-Control Commands

The following chapter describes the remote-control commands for the application firmware. An alphabetical list at the end of this chapter provides an overview of the commands.

The commands, which are also valid for the basic unit in the signal analyzer and vector signal analyzer modes as well as the system settings, are described in the operating manual of the analyzer.

CALCulate Subsystem

:CALCulate<1|2>:FEED <string>

This command selects the measured data that are to be displayed. .

Parameter: <string>::= 'XPOW:CDP' |
'XPOW:CDP:RAT' |
'XTIM:CDP:MACCuracy' |
'XTIM:CDP:PVSLot' |
'XTIM:CDP:BSTReam' |
'XTIM:CDP:ERR:SUMM' |
'XTIM:CDP:ERR:CTABle' |
'XTIM:CDP:ERR:PCDomain' |
'XTIM:CDP:SYMB:CONStellation' |
'XTIM:CDP:SYMB:EVM'

,

Example: ":CALC2:FEED 'XTIM:CDP:MACCuracy'"

Features: *RST value: 'XTIM:DDEM:MEAS' (vector signal analysis)
SCPI: conforming

Note: *For code domain power (CDP) measurements, the display is always operated in the SPLIT SCREEN mode and the assignment of display mode to measurement window is fixed. Therefore, the numeric suffix that is required or permitted is given in brackets for each display mode.*

The string parameters have the following meaning:

'XPOW:CDP'	Result display of code domain power as bargraph (CALCulate<1>)
'XPOW:CDP:RAT'	Result display of code domain power ratio as bargraph (CALCulate<1>)
'XTIM:CDP:ERR:SUMM'	Result display in tabular form (CALCulate2)
'XTIM:CDP:ERR:CTABle'	Result display of channel assignment table (CALCulate<1>)
'XTIM:CDP:ERR:PCDomain'	Result display of peak code domain error (CALCulate2)
'XTIM:CDP:MACCuracy'	Result display of composite EVM (error vector magnitude referred to the overall signal) (CALCulate2)
'XTIM:CDP:PVSLot'	Result display of power versus slot (CALCulate2)
'XTIM:CDP:BSTReam'	Result display of bit stream (CALCulate2)
'XTIM:CDP:SYMB:CONStellation'	Result display of symbol constellation (CALCulate2)
'XTIM:CDP:SYMB:EVM'	Result display of symbol error vector magnitude (CALCulate2)

:CALCulate:LIMit:ESPectrum:MODE AUTO | MANual | USER

This command switches on or off the automatic selection of limit lines for spectrum emission mask measurements.

Parameter:

AUTO	the set limit line depends on the measured channel power
MANUAL	one out of four fixed limit line is activated. The selection is done with command `CALC:LIM:ESP:VAL`
USER	only query possible, user-defined limit lines are switched on (see manual of instrument for description of limit line functions)

Example: `":CALC:LIM:ESP:MODE AUTO"`

Features:

*RST value:	AUTO
SCPI:	device-specific

:CALCulate:LIMit:ESPectrum:VALue <numeric_value>

This command switches to manual selection of limit lines. The limit line is selected by entering the expected power as a value. Depending on the value entered, one of four possible limit lines is selected:

Expected power in dBm	name of selected imit line	retrieved value
value ≥ 43	"P ≥ 43"	43
39 ≤ value < 43	"39 ≤ P < 43"	39
31 ≤ value < 39	"31 ≤ P < 39"	31
value < 31	"P < 31"	0

Example: `":CALC:LIM:ESP:VAL 39"` selects limit line "39 ≤ P < 43"

Features:

*RST value:	0
SCPI:	device-specific

:CALCulate<1|2>:MARKer<1>:FUNCtion:CPICh

This command sets the marker to channel 0 (Common Pilot Channel).

Example: `":CALC:MARK:FUNC:CPIC"`

Features:

*RST value:	_
SCPI:	device-specific

This command is an <Event> and has therefore neither *RST value nor query. Only the numeric suffix 1 is permissible in `MARKer`.

The numeric suffix in `CALCulate` that is required or permissible depends on the selected display mode for which the marker is to be valid and has to coincide with it:

CALCulate<1>	for CDP absolute and relative
CALCulate2	for composite EVM, peak code domain error, power versus slot, bit stream, symbol constellation and EVM

:CALCulate<1|2>:MARKer<1>:FUNCtion:PCCPch

This command sets the marker to channel 1.

Example: ":CALC:MARK:FUNC:PCCP"

Features: *RST value: _
SCPI: device-specific

This command is an <Event> and has therefore neither *RST value nor query. Only the numeric suffix 1 is permissible in MARKer.

The numeric suffix in CALCulate that is required or permissible depends on the selected display mode for which the marker is to be valid and has to coincide with it:

CALCulate<1> for CDP absolute and relative

CALCulate2 for composite EVM, peak code domain error, power versus slot, bit stream, symbol constellation and EVM

CALCulate<1>:MARKer<1>:FUNCtion:CRESt?

Queries the Crest factor in the time domain measurement. Only the numeric suffix 1 is permissible in CALCulate and MARKer.

Example: "CALC:MARK:FUNC:CRES?"

Features: *RST value: --
SCPI: device-specific

:CALCulate<1>:MARKer<1>:FUNCtion:WCDPower[:BTS]:RESult?
PTOTal | FERRor | TFRame | TOFFset | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFfset | IQIMbalance

This command queries the measured and calculated results of the WCDMA code domain power measurement.

Example: ":CALC:MARK:FUNC:WCDP:RES? PTOT"

Features: *RST value: -
SCPI: device-specific

PTOTal	total power	FERRor	frequency error in Hz
TFRame	trigger to frame	TOFFset	timing offset
MACCuracy	composite EVM	PCDerror	peak code domain error
EVMRms	error vector magnitude RMS	EVMPeak	error vector magnitude peak
CERRor	chip rate error	CSLot	channel slot number
SRATe	symbol rate	CHANnel	channel number
CDPabsolute	channel power absolute	CDPRelative	channel power relative
IQOFfset	IQ offset	IQIMbalance	IQ imbalance

:CALCulate:MARKer:Y:PERCent 0 to 100%

This command positions the marker in CCDF measurements to the selected percent value of the y-axis scaling (probability).

Example: ":CALC:MARK:Y:PERC 40"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate:STATistics - Subsystem

The CALCulate:STATistics subsystem controls the statistical measurement functions in the instrument. The measurement window cannot be selected with these functions. The numeric suffix in CALCulate is therefore ignored.

COMMAND	PARAMETER	UNIT	COMMENT
:CALCulate			
:STATistics			
[:BTS]			
:CCDF			
[:STATe]	<Boolean>		
:NSAMples	<numeric_value>	--	
:SCALe			
:Y			
:UPPer	<numeric_value>	--	
:LOWer	<numeric_value>	--	

:CALCulate:STATistics[:BTS]:CCDF[:STATe] ON | OFF

This command switches on or off the measurement of the complementary cumulative distribution function (CCDF).

Example: "CALC:STAT:CCDF ON"

Features: *RST value: OFF
SCPI: device-specific

:CALCulate:STATistics:NSAMples 100 to 32768

This command sets the number of measurement points to be acquired for the statistical measurement functions

Example: "CALC:STAT:NSAM 5000"

Features: *RST value: 10000
SCPI: device-specific

:CALCulate:STATistics:SCALe:Y:UPPer 1E-5 to 1.0

This command defines the upper limit for the Y-axis of the diagram in statitistical measurements. Since probabilities are specified on the Y-axis, the entered numerical values are dimensionless.

Example: "CALC:STAT:SCAL:Y:UPP 0.01"

Features: *RST value: 1.0
SCPI: device-specific

:CALCulate:STATistics:SCALe:Y:LOWer 1E-6 to 0.1

This command defines the lower limit for th Y-axis of the diagram in statistical measurements. Since probabilities are specified on the Y-axis, the entered numerical values are dimensionless.

Example: "CALC:STAT:SCAL:Y:LOW 0.001"

Features: *RST value: 1E-6
SCPI: device-specific

CONFigure:WCDPower Subsystem

This subsystem comprises the commands for configuring the code domain power measurements. Only the numeric suffix 1 is permissible in `CONFigure`.

CONFigure<1>:WCDPower[:BTS]:MEASurement POWer | ACLR| ESPectrum | OBANdwith | OBWidth | WCDPower | FDOMain | TDOMain | CCDF

This command selects the WCDMA base station tests. The settings of the predefined measurements are described for the associated softkey in chapter 6.

Parameter:

POWer	Channel power measurement (standard 3GPP WCDMA Forward) with predefined settings
ACLR	Adjacent channel power measurement (standard 3GPP WCDMA Forward) with predefined settings
ESPectrum	Measurement of spectrum emission mask
OBANdwith | OBWidth	Measurement of occupied power bandwidth
WCDPower	Code domain power measurement. This selection has the same effect as command `INSTrument:SELect WCDPower`.
FDOMain	Overview measurement in the frequency domain with predefined settings
TDOMain	Measurement of crest factor in the time domain with predefined settings
CCDF	Measurement of Complementary Cumulative Distribution Function

Example: `"CONF:WCDP:MEAS POW"`

Features: *RST value: POWer
SCPI: device-specific

CONFigure:WCDPower[:BTS]:CTABle[:STATe] ON | OFF

This command switches the channel table on or off. On switching on, the measured channel table is stored under the name RECENT and switched on. After the RECENT channel table is switched on, another channel table can be selected with the command `CONF:WCDP:CTABle:SELect`.

Note: *The RECENT channel table must always be switched on first with the command* `CONF:WCDP:CTAB:STAT` *and then the required channel table can be selected with the command* `CONF:WCDP:CTAB:SEL`

Example: `":CONF:WCDP:CTAB ON"`

Features: *RST value: OFF
SCPI: device-specific

CONFigure:WCDPower[:BTS]:CTABle:SELect <string>

This command selects a predefined channel table file. Before using this command, the RECENT channel table must be switched on first with the command `CONF:WCDP:CTAB:STATe ON`.

Example: `":CONF:WCDP:CTABle ON"`
`":CONF:WCDP:CTAB:SEL '3GB_1_32'"`

Features: *RST value: "RECENT"
SCPI: device-specific

:CONFigure:WCDPower[:BTS]:CTABle:NAME <file_name>

This command selects an existing channel table or creates the name of a new channel table.

Example: ":CONF:WCDP:CTAB:NAME 'NEW_TAB'"

Features: *RST value: "RECENT"
SCPI: device-specific

:CONFigure:WCDPower[:BTS]:CTABle:DATA
2..9,0..511,0 | 1,<numeric_value> | AUTO,2 | 4 | 8 | 16,0 | 1,<numeric_value>...

This command defines the values of the selected channel table.

Each line of the table consists of 8 values:
<code class>,<code number>,<use TFCI>,<timing offset | AUTO>,<pilot length>,<pitch>,<status>,<CDP relative [dB]>....

Code class:	2 to 9	
Code number:	0 to 511	
use TFCI:	0: not used, 1: used	
Timing offset:	0 to 38400, for code class 9, the step width is 512, else 256, for AUTO, the timing offset is calculated by the instrument	
Pilot length:	code class 9:	4
	code class 8:	2, 4, 8
	code class 7:	4, 8
	code class 5/6:	8
	code class 2/3/4	16
Pitch:	0: normal channel, 1: pitch channel	
Status:	0: not active, 1:active	
CDP relative:	for setting commands any value, for query CDP relative value	

Channels PICH, CPICH and PCCPCH may only be defined once. If channel CPICH or PCCPCH is missing in the command, it is automatically added at the end of the table.

Prior to this command, the name of the channel table has to be defined with command CONF:WCDP:CTAB:NAME.

Example: ":CONF:WCDP:CTAB:DATA 8,0,0,0,0,0,1,0.00,
8,1,0,0,0,0,1,0.00,7,1,0,256,8,0,1,0.00"
2 channels are defined: CPICH, PCCPCH and a channel in code class 7

Features: *RST value: -
SCPI: device-specific

:CONFigure:WCDPower[:BTS]:CTABle:COMMent <string>

This command defines a comment for the selected channel table

Prior to this command, the name of the channel table has to be defined with command CONF:WCDP:CTAB:NAME and the values of the table have to be defined with command CONF:WCDP:CTAB:DATA.

Example: ":CONF:WCDP:CTAB:COMM 'Comment for table 1'"

Features: *RST value: ""
SCPI: device-specific

:CONFigure:WCDPower[:BTS]:CTABle:COPY <file_name>

This command copies one channel table onto another one. The channel table to be copied is selected with command `CONF:WCDP:CTAB:NAME`.

Parameter: <file_name> ::= name of the new channel table

Example: `":CONF:WCDP:CTAB:COPY 'CTAB_2'"`

Features: *RST value: --
SCPI: device-specific

The name of the channel table may contain a maximum of 8 characters. This command is an "event" which is why it is not assigned an *RST value and has no query.

:CONFigure:WCDPower[:BTS]:CTABle:DELete

This command deletes the selected channel table. The channel table to be deleted is selected with command `CONF:WCDP:CTAB:NAME`.

Example: `":CONF:WCDP:CTAB:DEL"`

Features: *RST value: --
SCPI: device-specific

This command is an "event" which is why it is not assigned an *RST value and has no query.

:CONFigure:WCDPower[:BTS]:CTABle:RESTore

This command restores the default channel tables preset upon instrument delivery.

Example: `":CONF:WCDP:CTAB:REST`

Features: *RST value: --
SCPI: device specific

This command is an "event" which is why it is not assigned an *RST value and has no query.

:CONFigure:WCDPower[:BTS]:CTABle:CATalog?

This command reads out the names of all channel tables stored on the harddisk.

Syntax of output format:

<Sum of file lengths of all subsequent files>,<free memory on hard disk>,
<1st file name>,,<1st file length>,<2nd file name>,,<2nd file length>,....,<nth file name>,
<nth file length>

Example: `":CONF:WCDP:CTAB:CAT?"`

Features: *RST value: --
SCPI: device-specific

INSTrument Subsystem

:INSTrument[:SELect] SANalyzer | DDEMod | ADEMod | BGSM | MSGM | CDPower | **WCDPower|BWCDpower**

This command switches between the operating modes by means of text parameters.

Selection BWCDpower or WCDPower presets the instrument as described in Chapter 2, Section "Basic Settings in Code Domain Measurement Mode".

Example: `":INST BWCD"`

Features: *RST value: SANalyzer
SCPI: conforming

SENSe:CDPower Subsystem

This subsystem controls the parameters for the code domain mode. The numeric suffix in `SENSe<1|2>` is not significant in this subsystem.

:[SENSe:]CDPower:SFACtor 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512

This command defines the spreading factor. The spreading factor is only significant for display mode PEAK CODE DOMAIN ERROR.

Example: `":SENS:CDP:SFACtor 16"`

Features: *RST value: 512
SCPI: device-specific

:[SENSe:]CDPower:CODE 0 to 511

This command sets the code number. The code number refers to code class 9 (spreading factor 512).

Example: `":SENS:CDP:CODE 30"`

Features: *RST value: 0
SCPI: device-specific

:[SENSe:]CDPower:NORMalize ON | OFF

This command switches normalization of the unit circle with the IQ offset on or off.

Example: `":SENS:CDP:NORM OFF"`

Features: *RST value: OFF
SCPI: device-specific

Mode: WCDP

:[SENSe:]CDPower:QINVert ON | OFF

This command inverts the Q component of the signal.

Example: ":SENS:CDP:QINV ON"

Features: *RST value: OFF
SCPI: device-specific

Mode: WCDP

:[SENSe:]CDPower:SLOT 0 to 14

This command sets the slot number of the common pilot channels (CPICH).

Example: ":SENS:CDP:SLOT 3"

Features: *RST value: 0
SCPI: device-specific

:[SENSe:]CDPower:PRESet

This command sets the parameters of the WCDMA measurement to predefined values (see softkey *CDP AUTO ADJUST* in chapter 6).

Example: ":CDP:PRES"

Features: *RST value: -
SCPI: device-specific

This command is an <Event> and has therefore neither *RST value nor query.

:[SENSe:]CDPower:SBANd NORMal | INVers

This command is for interchanging the left and the right sideband.

Example: ":CDP:CDP:SBAN INV"

Features: *RST value: INV
SCPI: device-specific

Mode: WCDP

:[SENSe:]CDPower:LCODe[:VALue] #H0 to #H1fff

This command defines the scrambling code in hexadecimal format.

Example: ":CDP:LCOD #H2"

Features: *RST value: 0
SCPI: device-specific

:[SENSe:]CDPower:ICTReshold -50 dB to + 10 dB

This command sets the threshold value from which a channel is treated as active. The level entered refers to the total signal power.

Example: ":CDP:ICTR -10DB"

Features: *RST value: -20 dB
SCPI: device-specific

:[SENSe:]CDPower:LEVel:ADJust

This command is used for setting automatically the RF attenuation and IF gain to the level of the applied signal. The instrument is to be switched to the *ATTEN MANUAL* mode so as to set the RF attenuation and IF gain separately to optimum values. This mode is maintained after changing from code domain power measurements to the analyzer or vector analyzer modes.

Example: `":CDP:LEV:ADJ"`

Features: *RST value: -
SCPI: device-specific

This command is an <Event> and has therefore neither *RST value nor query.

:[SENSe:]CDPower:PREFerence TOTal | CPICh

This command switches between the use of total power or CPICH power as reference for the relative CDP measurement values.

Example: `":SENS:CDP:PREF CPIC"`

Features: *RST value: TOTal
SCPI: device-specific

:[SENSe<1|2>:]CDPower:STYPe CPICh | SCHannel

This command selects the type of synchronization.

CPICh — Synchronizaton to CPICH (default). The CPICH has to be contained in signal.

SCHannel — Synchronization without CHICH. This type of synchronization is provided for test model 4 which is defined with or without CPICH.

Example: `":CDP:STYP SCH"`

Features: *RST value: CPICh
SCPI: device-specific

:[SENSe<1|2>:]CDPower:ANTenna OFF | 1 | 2

This command switches the antenna diversity mode on or off and selects the antenna of the diversity path.

OFF — Antenna diversity mode switched off.

1 | 2 — According to 3 GPP, the pilot symbols of the channels are different depending on the antenna used. The CPICH symbols are different and the synchronization channels are transmitted alternately in every second slot.

Example: `":CDP:ANT 1"`

Features: *RSTvalue: OFF
SCPI: device-specific

TRACe Subsystem

:TRACe[:DATA] TRACE1 | TRACE2 | ABITstream | PWCDp | CTABle

This command transfers trace data from the controller to the instrument, the query reads trace data out of the instrument.

Example:
```
":TRAC TRACE1,"+A$    (A$: data list in current format)
":TRAC? TRACE1"
```

Features: *RST value: -
SCPI: conforming

Only TRACE1, TRACE2, PWCDp, ABITstream or CTABle can be queried depending on the display mode.

CODE PWR ABSOLUTE / RELATIVE , CHANNEL TABLE (TRACE1)

Each channel is defined by the class, the channel number, the absolute level, the relative level and the timing offset. The class denotes the spreading factor of the channel.

Class 9 corresponds to the highest spreading factor (512, symbol rate 7.5 ksps), class 2 to the lowest admissible spreading factor (4, symbol rate 960 ksps).

Five values are transmitted for each channel.

< class>,<cannel number>,<absolute level>,<relative level>,<timing offset>, ...

For CODE PWR ABSOLUTE / RELATIVE, the channels are output in ascending order sorted according to the code numbers, i.e in the same sequence as they are displayed on the screen. For CHANNEL TABLE, the channels are sorted according to the code classes, i.e. the unassigned channels are transmitted last.

The units are:

Absolute level	dBm,
Relative level	dB referred to CPICH.
Timing offset	chips

The example shows the results of a query for three channels with the following configuration:

1st channel: spreading factor 512, channel number 7, timing offset 0
2nd channel: spreading factor 4, channel number 1, timing offset 256 chips
3rd channel: spreading factor 128, channel number 255, timing offset 2560 hips

This yields the following result: 9,7,-40,-20,0,2,1,-40,-20,256,7,255,-40,-20,2560

The channels come in the same order as in the CDP diagram, i.e. depending on their position in the code domain of spreading factor 512.

CODE PWR ABSOLUTE / RELATIVE (PWCDp) , CHANNEL TABLE (PWCDp)

PWCDp can be set for only if CODE PWR ABSOLUTE / RELATIVE , CHANNEL TABLE is selected for Screen A. The pilot length is transmitted in addition to the same five values as transmitted for TRACE1:
< class>,<cannel number>,<absolute level>,<relative level>,<timing offset> or <I/Q-mapping>, <pilot length>,...

The pilot length is given in symbols.

CODE PWR ABSOLUTE / RELATIVE (CTABle) , CHANNEL TABLE (CTABle)

CTABle can be set for only if CODE PWR ABSOLUTE / RELATIVE , CHANNEL TABLE is selected for Screen A. The channel status (0 = inactive; 1 = active) is transmitted in addition to the same six values as transmitted for PWCDp:
< class>,<cannel number>,<absolute level>,<relative level>,<timing offset> or <I/Q-mapping>, <pilot length>, <channel status>...

RESULT SUMMARY (TRACE2)

The results of the RESULT SUMMARY are output in the following order:

<composite EVM>,<peak CDE>,<carr freq Error>,<chip rate error>,
<total power>,<trg to frame>,<EVM peak channel>,<EVM mean channel>, <class>,
<channel number>,<power abs. channel>,<power rel. channel>,<timing offset>,
<IQ offset>,<IQ imbalance>

The units are:

EVM peak channel/mean channel, composite EVM, IQ offset/imbalance : %,
Peak CDE, total power and power abs. channel dB.
Power rel. Channel dB referred to CPICH.
Carr freq error : Hz
Chip Rate Error ppm.
Timing offset chips
Trg to Frame µs.

POWER VS SLOT (TRACE2)

16 pairs of slot (slotnumber of CPICH) and level values (for 16 slots) are always transferred.
<slot number>, <level value in dB>,<slot number>,<level value in dB>,.....

SYMBOL EVM (TRACE2)

The number of level values depends on the spreading factor:

Spreading factor 512 5 values
Spreading factor 256 10 values
Spreading factor 128 20 values
Spreading factor 64 40 values
Spreading factor 32 80 values
Spreading factor 16 160 values
Spreading factor 8 320 values
Spreading factor 4 640 values

PEAK CODE DOMAIN ERR and COMPOSITE EVM (TRACE2)

15 pairs of slot (slotnumber of CPICH) and level values are always transferred.
PEAK CODE DOMAIN ERR: <slot number>, <level value in dB>,.....
COMPOSITE EVM: <slot number>, <level value in %>, ...

SYMBOL CONST DIAG(TRACE2)

The real and the imaginary part are transferred as a pair:
<re 0>,<im 0>,<re 1>,<im 1>,.....<re n>, <im n>

The number of level values depends on the spreading factor:

Spreading factor 512 5 values
Spreading factor 256 10 values
Spreading factor 128 20 values
Spreading factor 64 40 values
Spreading factor 32 80 values
Spreading factor 16 160 values
Spreading factor 8 320 values
Spreading factor 4 640 values

BITSTREAM (TRACE2)

The bitstream of one slot is transferred. One value is transferred per bit (range 0,1,). The number of symbols is not constant and may vary for each sweep. Specific symbols in the bitstream may be invalid depending on the channel type and the bit rate (symbols without power). The assigned invalid bits are marked by "9".

Example for a bitstream trace: 0,1,0,9,0,1, ...

BITSTREAM (ABITstream)

ABITstream can be set only if `CALC2:FEED "XTIM:CDP:BSTReam"` is selected (in the lower bitstream window). This command returns the bitstreams of all 15 slots one after the other, the output format may be REAL, UINT or ASCII.

Alphabetical List of Commands

Command	Parameter	Page
:CALCulate:LIMit:ESPectrum:MODE	AUTO | MANual | USER	67
:CALCulate:LIMit:ESPectrum:VALue	<numeric_value>	67
:CALCulate:MARKer:Y:PERCent	0 to 100	68
:CALCulate:STATistics: SCALe:Y:LOWer	-1E-6 to 0.1	69
:CALCulate:STATistics:NSAMples	100 to 32768	69
:CALCulate:STATistics:SCALe:Y:UPPer	-1E-5 to 1.0	69
:CALCulate:STATistics[:BTS]:CCDF[:STATe]	ON | OFF	69
:CALCulate<1|2>:FEED	'XPOW:CDP' | 'XPOW:CDP:RAT' 'XTIM:CDP:MACCuracy' | 'XTIM:CDP:PVSLot' | 'XTIM:CDP:BSTReam' 'XTIM:CDP:ERR:CTABle' | 'XTIM:CDP:ERR:SUMM' | 'XTIM:CDP:ERR:PCDomain' | 'XTIM:CDP:SYMB:CONStellation' | 'XTIM:CDP:SYMB:EVM'|	66
:CALCulate<1>:MARKer<1>:FUNCtion:CRESt?		68
:CALCulate<1|2>:MARKer<1>:FUNCtion:CPICH		67
:CALCulate<1|2>:MARKer<1>:FUNCtion:PCCPch		68
:CALCulate<1>:MARKer<1>:FUNCtion:WCDPower[:BTS]:RESult?	PTOTal | FERRor | TFRame | TOFFset | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFfset | IQIMbalance	68
:CONFigure<1>:WCDPower[:BTS]:CTABle:CATAlog?		72
:CONFigure<1>:WCDPower[:BTS]:CTABle:COMMent	<string>	71
:CONFigure<1>:WCDPower[:BTS]:CTABle:COPY	<file_name>	72
:CONFigure<1>:WCDPower[:BTS]:CTABle:DATA	2 to 9, 0 to 511, 0 | 1, <numeric_value> | AUTO, 2|4|8|16 , 0|1, <numeric_value>....	71
:CONFigure<1>:WCDPower[:BTS]:CTABle:DELete		72
:CONFigure<1>:WCDPower[:BTS]:CTABle:NAME	<file_name>	71
:CONFigure<1>:WCDPower[:BTS]:CTABle:RESTore		72
:CONFigure<1>:WCDPower[:BTS]:CTABle:SELect	<string>	70
:CONFigure<1>:WCDPower[:BTS]:CTABle[:STATe]	ON | OFF	70
:CONFigure<1>:WCDPower[:BTS]:MEASurement	POWer | ACLR | ESPectrum | OBANdwidth|OBWidth | WCDPower | FDOMain | TDOMain | CCDF	70
:INSTrument[:SELect]	WCDPower|BWCDpower	73
:[SENSe:]CDPower:ANTenna	OFF | 1 | 2	75
:[SENSe:]CDPower:CODE	0 to 511	73
:[SENSe:]CDPower:ICTReshold	–50 to 10 dB	74
:[SENSe:]CDPower:LCODe[:VALue]	#H0 to #H1fff	74
:[SENSe:]CDPower:LEVel:ADJust		75
:[SENSe:]CDPower:NORMalize	ON | OFF	73
:[SENSe:]CDPower:PREFerence	TOTal | CPICh	75
:[SENSe:]CDPower:PRESet		74
:[SENSe:]CDPower:QINVert	ON | OFF	74
:[SENSe:]CDPower:SBAND	NORMal | INVers	74
:[SENSe:]CDPower:SFACtor	4 | 8 | 16 | 32 | 64 | 128 | 256 | 512	73
:[SENSe:]CDPower:SLOT	0 .to 14	74
:[SENSe:]CDPower:STYPe	CPICh | SCHannel	75
:TRACe[:DATA]	TRACE1| TRACE2 | ABITstream | PWCDp | CTABle	76

Table of Softkeys with Assignment of IEC/IEEE Commands

CONFIGURATION Key Group

MODE

3GPP BTS ANALYZER

```
:INSTrument:SELect BWCDpower
```

POWER

```
:CONFigure<1>:WCDPower:MEASurement POWer
```

Query of results: `:CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? CPOWer`

ACLR

```
:CONFigure<1>:WCDPower:MEASurement ACLR
```

Query of results: `:CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? ACPower`

SPECTRUM EM MASK

```
:CONFigure:WCDPower:MEASurement ESPectrum
```

Query of results: `:CALCulate<1>:LIMit<1>:FAIL?`

LIMIT LINE AUTO

```
:CALCulate<1>:LIMit<1>:ESPectrum:MODE AUTO
```

LIMIT LINE MANUAL

```
:CALCulate<1>:LIMit<1>:ESPectrum:MODE MANual
:CALCulate<1>:LIMit<1>:ESPectrum:VALue <numeric_value>
```

LIMIT LINE USER

```
:CALCulate:LIMit<1>:NAME <string>
:CALCulate:LIMit<1>:UNIT DBM
:CALCulate:LIMit<1>:CONTrol[:DATA] <num_value>, <num_value>, ...
:CALCulate:LIMit<1>:CONTrol:DOMain FREQuency
:CALCulate:LIMit<1>:CONTrol:TRACe 1
:CALCulate:LIMit<1>:CONTrol:OFFset <num_value>
:CALCulate:LIMit<1>:CONTrol:MODE   RELative

:CALCulate:LIMit<1>:UPPer[:DATA] <num_value>, <num_value>..
:CALCulate:LIMit<1>:UPPer:STATe   ON | OFF
:CALCulate:LIMit<1>:UPPer:OFFset <num_value>
:CALCulate:LIMit<1>:UPPer:MARGin <num_value>
:CALCulate:LIMit<1>:UPPer:MODE  ABSolute
:CALCulate:LIMit<1>:UPPer:SPACing LINear
```

Notes:

- If the y values are entered using the command:`CALCulate:LIMit<1>:LOWer[:DATA]` the limit check yields "failed" if the values are below the limit line.
- If a user-defined limit line is activated, it has priority over limit lines selected via AUTO und MANUAL.

OCCUPIED BANDWIDTH

```
:CONFigure<1>:WCDPower:MEASurement OBANdwidth
```

Query of results: `:CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? OBANdwidth`

SPECTRUM

```
:CONFigure<1>:WCDPower:MEASurement FDOMain
```

Query of results: -- (visual evaluation)

TIME DOMAIN

```
:CONFigure<1>:WCDPower:MEASurement TDOMain
```

Query of results:

```
:CALCulate<1>:MARKer<1>:FUNCtion:CRESt?
:CALCulate<1>:MARKer<1>:FUNCtion:SUMMary:RMS:RESult?
:CALCulate<1>:MARKer<1>:FUNCtion:SUMMary[:STATe] ON
```

CCDF

```
:CONFigure:WCDPower:MEASurement CCDF    or
:CALCulate:STATistics[:BTS]:CCDF[:STATe] ON
```

Query of results: `CALCulate:MARKer:X?`

PERCENT MARKER

```
:CALCulate:MARKer:Y:PERCent 1 to 100%
```

NO OF SAMPLES

```
CALCulate:STATistics:NSAMamples 1 to 32768
```

AVERAGE ON OFF

```
:DISPlay[:WINDow]:TRACe<1>:MODE  AVERage | VIEW
```

SWEEP COUNT

```
:[SENSe<1|2>:]:SWEep:COUNt 6
```

Y MAX

```
:CALCulate:STATistics:SCALe:Y:UPPer 1E-5 to 1
```

Y MIN

```
:CALCulate:STATistics:SCALe:Y:LOWer 1E-6 to 0.1
```

CODE DOM POWER

```
:INSTrument<1>[:SELect] WCDPower
```

Query of results:

```
:TRACe:DATA? TRACE1 | TRACE2 | ABITstream| PWCDp | CTABle
```

or

```
:CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower:RESult?
        PTOTal | FERRor | TFRame | TOFFset | MACCuracy |
        PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe |
        CHANnel | CDPabsolute | CDPRelative | IQOFfset |
        IQIMbalance
```

or Marker functions (see MARKER submenu)

CONTINUOUS SWEEP

```
:INITiate<1>:CONTinuous ON; INITiate<1>[:IMMediate]
```

SINGLE SWEEP

```
:INITiate<1>:CONTinuous OFF; INITiate<1>[:IMMediate]
```

RESULT DISPLAY

```
--
```

CODE PWR RELATIVE

```
:CALCulate<1>:FEED  'XPOW:CDP:RAT'
```

CODE PWR ABSOLUTE

```
:CALCulate<1>:FEED  'XPOW:CDP'
```

CODE PWR ZOOM

```
--
```

COMPOSITE EVM

```
:CALCulate2:FEED "XTIM:CDP:MACCuracy"
```

PEAK CODE DOMAIN ERR

```
:CALCulate2:FEED "XTIM:CDP:ERR:PCDomain"
```

POWER VS SLOT

```
:CALCulate2:FEED "XTIM:CDP:PVSLot"
```

RESULT SUMMARY

```
:CALCulate2:FEED "XTIM:CDP:ERR:SUMMary"
```

Result query:

```
:CALCulate:MARKer:FUNCtion:WCDPower[:BTS]:RESult?
 PTOTal | FERRor | TFRame | TOFFset | MACCuracy | PCDerror | EVMRms |
EVMPeak | CERRor | CSLOt | SRATe | CHANnel | CDPabsolute | CDPRelative
| IQOFfset | IQIMbalance
```

SELECT PCDE SF

```
:[SENSe:]CDPower:SFACtor 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512
```

SELECT CODE NO.

```
:[SENSe:]CDPower:CODE 0 to 511
```

SELECT CPICH SLOT

```
:[SENSe:]CDPower:SLOT 0 to 14
```

CHANNEL TABLE

```
:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABle"
```

SYMBOL CONST DIAG	:CALCulate2:FEED "XTIM:CDP:SYMB:CONStellation"
SYMBOL EVM	:CALCulate2:FEED "XTIM:CDP:SYMB:EVM"
BITSTREAM	:CALCulate2:FEED "XTIM:CDP:SYMB:BITStream"
CODE CHAN CONFIG	--
CODE CHAN AUTOSEARCH	:CONFigure:WCDPower[:BTS]:CTABle[:STATe] OFF
CODE CHAN PREDEFINED	:CONFigure:WCDPower[:BTS]:CTABle[:STATe] ON :CONFigure:WCDPower[:BTS]:CTABle:SELect <channel table name>
EDIT CHAN CONF TABLE	
CHAN TABLE HEADER	:CONFigure:WCDPower[:BTS]:CTABle:NAME "channel table name" :CONFigure:WCDPower[:BTS]:CTABle:COMMent "comment for new table"
CHAN TABLE VALUES	:CONFigure:WCDPower[:BTS]:CTABle:NAME "channel table name" :CONFigure:WCDPower[:BTS]:CTABle:DATA <numeric_value>
ADD PICH	--
INSERT LINE	--
DELETE LINE	
MEAS CHAN CONF TABLE	--
SAVE TABLE	(automatically executed in remote control)
SORT TABLE	--
NEW CHAN CONF TABLE	See EDIT CHAN CONF TABLE
DEL CHAN CONF TABLE	:CONFigure:WCDPower[:BTS]:CTABle:NAME "channel table name" :CONFigure:WCDPower[:BTS]:CTABle:DELete
COPY CHAN CONF TABLE	:CONFigure:WCDPower[:BTS]:CTABle:NAME "channel table name" :CONFigure:WCDPower[:BTS]:CTABle:COPY "new channel table name"
RESTORE TEST MOD.	:CONFigure:WCDPower[:BTS]:CTABle:RESTore
MARKER	--
MARKER	:CALCulate<1|2>:MARKer<1>[:STATe] ON | OFF; :CALCulate<1|2>:MARKer<1>:X <numeric_value>; :CALCulate<1|2>:MARKer<1>:Y?
MARKER -> CPICH	:CALCulate<1|2>:MARKer<1>:FUNCtion:CPICh; :CALCulate<1|2>:MARKer<1>:Y?
MARKER -> PCCPCH	:CALCulate<1|2>:MARKer<1>:FUNCtion:PCCPch; :CALCulate<1|2>:MARKer<1>:Y?
MEAS SETTINGS	--

SCRAMBLING CODE	:[SENSe:]CDPower:LCODe[:VALue) #H0 to #H1fff <hex>
INACT CHAN TRESH	:[SENSe:]CDPower:ICTReshold -50 dB to +10 dB
TRIGGER INT EXT	:TRIGger[:SEQuence]:SOURce IMMediate | EXTernal
EXT TRG OFFSET	:TRIGger<1>[:SEQuence]:HOLDoff <num_value>
POWER REF TOT CPICH	:[SENSe:]CDPower:PREFerence TOTal | CPICh
INVERT Q	:[SENSe:]CDPower:QINVert ON | OFF
SIDE BAND NORM INV	:[SENSe:]CDPower:SBANd NORMal | INVerse
NORMALIZE ON OFF	:[SENSe:]CDPower:NORMalize ON | OFF
CENTER FREQUENCY	:[SENSe:]FREQuency:CENTer <num_value>
SYNC TYPE CPICH SCH	:[SENSe:]CDPower:STYPe CPICHh | SCHannel
ANT DIV ON OFF	:[SENSe:]CDPower:ANTenna OFF | 1 | 2
ANT NO. 1 2	:[SENSe:]CDPower:ANTenna OFF | 1 | 2
REF LEVEL	--
REF LEVEL	:DISPlay[:WINDow<1|2>]:TRACe<1|2>:Y[:SCALe]:RLEVel <num_value>
REF LEVEL OFFSET	:DISPlay[:WINDow<1|2>]:TRACe<1|2>:Y[:SCALe]:RLEVel:OFFSet <num_value>
RF ATTEN MANUAL	:INPut<1|2>:ATTenuation <num_value>
ATTEN AUTO NORMAL	:INPut<1|2>:ATTenuation:AUTO:MODE NORMal; :INPut<1|2>:ATTenuation:AUTO ON
ATTEN AUTO LOW NOISE	:INPut<1|2>:ATTenuation:AUTO:MODE LNOise; :INPut<1|2>:ATTenuation:AUTO ON
ATTEN AUTO LOW DIST	:INPut<1|2>:ATTenuation:AUTO:MODE LDIStortion; :INPut<1|2>:ATTenuation:AUTO ON
MIXER LEVEL	:INPut<1|2>:MIXer <num_value>
LEVEL AUTO ADJUST	:[SENSe:]CDPower:LEVel:ADJust
CDP AUTO ADJUST	:[SENSe:]CDPower:PRESet

STATus QUEStionable:SYNC Register

This register comprises information about error status of the CDP measurements of application FSIQK72.
It can be queried with commands `STATus:QUEStionable:SYNC:CONDition?` and `"STATus :QUEStionable:SYNC[:EVENt]?`.

Table 1 Meaning of bits in STATus:QUEStionable:SYNC register

Bit No.	Meaning
0 to 5/7	not used in FSIQK72
6	**K72 Check Pilot Symbols** This bit is set if invalid sequences were found during the check of the pilot symbols of the data channels.
8	**K72 Evaluation Error** This bit is set if an error that the subsequent bits do not describe in greater detail has occurred during the data evaluation for the code domain power analysis.
9	**K72 Bad long code number** This bit is set if an invalid scrambling code was entered.
10	**K72 Frame sync failed** This bit is set if the synchronization to a frame was not possible.
11	**K72 Slot format not supported** This bit is set if the channel table contains an invalid slot format.
12	**K72 Channel type not supported** This bit is set if the channel table contains an unvalid channel type. Supported channel types are DPCH and PICH.
13	**K72 No active channel** This bit is set if no active channel was found.
14	**K72 No waveQual symbols on** This bit is set if the EVM measurement is aborted because ON symbols are not available
15	This bit is always 0.

8 Performance Test

- Switch off FSIQ before removing or inserting modules.
- Check the setting of the AC supply voltage selector (230 V) prior to switching on the unit.
- Measure the parameters after a warm-up time of at least 30 min. and the completion of system error correction of FSIQ and SMIQ. Only then is it ensured that the specifications are complied with.
- Unless specified otherwise all settings are made after a PRESET.
- Conventions for settings on FSIQ during the measurement:

[***<Key>***]	Press a key on the front panel, eg [SPAN]
[<SOFTKEY>]	Press a softkey, eg [MARKER -> PEAK]
[<nn unit>]	Enter a value and terminate by entering the unit, eg [12 kHz]
{<nn>}	Enter values indicated in one of the following tables.

Successive entries are separated by [:], eg [***SPAN***: 15 kHz].

- The values stated hereinafter are not guaranteed values. Only the data sheet specifications are binding.

Required Measuring Equipment and Accessories

Table 8-1 Required Measuring Equipment and Accessories

Item	Instrument type	Recommended characteristics	Recommended equipment	R&S Order No.	Use
1	Signal generator	Vector signal generator for generating cdmaOne signals	SMIQ with options: SMIQB42 SMIQB20 SMIQB11	1125.5555.xx 1104.7936.02 1125.5190.02 1085.4502.04	

Test Procedure

The performance test refers exclusively to results of the code-domain power.
It is not required to check the POWER-, ACLR- and SPECTRUM results since they are covered by the performance test of the basic unit.

Default settings on SMIQ:

[PRESET]
[LEVEL : *0 dBm]*
[FREQ: *2.1175 GHz]*
DIGITAL STD
WCDMA 3GPP
TEST MODELS ...
TEST1_32
SELECT BS/MS
BS 1 ON
PICH STATE: OFF
STATE: ON

Trigger output: *RADIO FRAME*

Check set channels against the following table:

CHNO	TYPE	SYM.R	CH.CD	POW	DATA	TOFFS	PILOT	TPC	MC	STATE
0	P-CPICH	15	0	-10.0					OFF	ON
2	P-SCH	15		-13.0					OFF	ON
3	S-SCH	15		-13.0					OFF	ON
4	P-CCPCH	15	1	-10.0	PN9					ON
11	DPCH	30	2	-13.0	PN9	86	8	PATTOFF		ON
12	DPCH	30	11	-13.0	PN9	134	8	PATTOFF		ON
13	DPCH	30	17	-14.0	PN9	52	8	PATTOFF		ON
14	DPCH	30	23	-15.0	PN9	45	8	PATTOFF		ON
15	DPCH	30	31	-17.0	PN9	143	8	PATTOFF		ON
16	DPCH	30	38	-14.0	PN9	112	8	PATTOFF		ON
17	DPCH	30	47	-16.0	PN9	59	8	PATTOFF		ON
18	DPCH	30	55	-18.0	PN9	23	8	PATTOFF		ON
19	DPCH	30	62	-16.0	PN9	1	8	PATTOFF		ON
20	DPCH	30	69	-19.0	PN9	88	8	PATTOFF		ON
21	DPCH	30	78	-17.0	PN9	30	8	PATTOFF		ON
22	DPCH	30	85	-15.0	PN9	18	8	PATTOFF		ON
23	DPCH	30	94	-17.0	PN9	30	8	PATTOFF		ON
24	DPCH	30	102	-22.0	PN9	61	8	PATTOFF		ON
25	DPCH	30	113	-20.0	PN9	128	8	PATTOFF		ON
26	DPCH	30	119	-24.0	PN9	143	8	PATTOFF		ON
27	DPCH	30	7	-20.0	PN9	83	8	PATTOFF		ON
28	DPCH	30	13	-18.0	PN9	25	8	PATTOFF		ON
29	DPCH	30	20	-14.0	PN9	103	8	PATTOFF		ON
30	DPCH	30	27	-14.0	PN9	97	8	PATTOFF		ON
31	DPCH	30	35	-15.0	PN9	56	8	PATTOFF		ON
32	DPCH	30	41	-19.0	PN9	104	8	PATTOFF		ON
33	DPCH	30	51	-18.0	PN9	51	8	PATTOFF		ON
34	DPCH	30	58	-17.0	PN9	26	8	PATTOFF		ON
35	DPCH	30	64	-22.0	PN9	137	8	PATTOFF		ON
36	DPCH	30	74	-19.0	PN9	65	8	PATTOFF		ON
37	DPCH	30	82	-19.0	PN9	37	8	PATTOFF		ON
38	DPCH	30	88	-16.0	PN9	125	8	PATTOFF		ON
39	DPCH	30	97	-18.0	PN9	149	8	PATTOFF		ON
40	DPCH	30	108	-15.0	PN9	123	8	PATTOFF		ON
41	DPCH	30	117	-17.0	PN9	83	8	PATTOFF		ON
42	DPCH	30	125	-12.0	PN9	5	8	PATTOFF		ON

all other channels STATE OFF

Default settings on FSIQ:

[PRESET]
[CENTER: *2.1175 GHz]*
[REF: *10 dBm]*
[MODE: *3GPP BTS ANALYZER: CODE DOM POWER*
MEAS SETTINGS *SCRAMBLING CODE 0*
MEAS SETTINGS *TRIGGER EXT*
RESULT DISPLAY *CHANNEL TABLE*

Test setup and other settings

➢ Connect external trigger input of FSIQ to SMIQ

*[**TRIGGER**: TRIGGER OFFSET: 0µs]*

➢ Connect external reference output of FSIQ to SMIQ

SMIQ *UTILITIES*
REF OSC
SOURCE: EXT

FSIQ *[**SETUP**: REFERENCE INT]*

The display of the FSIQ should show the following:

Ref Lvl 10 dBm — CF 2.1175 GHz SR 15 ksps — Channel Table — Chan Code 0 — CPICH Slot 0 — Chan Slot 0

CHANNEL TABLE

Type	Symb R.	Code#	Status	TFCI	PilotL	PWR ABS	PWR REL	T Offs
CPICH	15 ksps	0	active	---	--	-11.59	0.00	---
PSCH	15 ksps	---	active	---	--	-.--	-.--	---
SSCH	15 ksps	---	active	---	--	-.--	-.--	---
PCCPCH	15 ksps	1	active	---	--	-11.59	0.01	---
DPCH	30 ksps	2	active	OFF	8	-14.61	-3.02	22016
DPCH	30 ksps	7	active	OFF	8	-21.54	-9.94	21248
DPCH	30 ksps	11	active	OFF	8	-14.59	-3.00	34304
DPCH	30 ksps	13	active	OFF	8	-19.61	-8.01	6400
DPCH	30 ksps	17	active	OFF	8	-15.57	-3.97	13312
DPCH	30 ksps	20	active	OFF	8	-15.60	-4.01	26368
DPCH	30 ksps	23	active	OFF	8	-16.59	-4.99	11520

A SGL

Ref Lvl 10 dBm — CF 2.1175 GHz SR 15 ksps — Result Summary — Chan Code 0 — CPICH Slot 0 — Chan Slot 0

RESULT SUMMARY

GLOBAL RESULTS			
Total PWR	-1.72 dBm	Carr Freq Err	69.00 mHz
Chip Rate Err	-0.04 ppm	Trg to Frame	70 ns
IQ Offset	0.00 %	IQ Imbalance	0.58 %
Modulation Acc	2.62 % rms	Pk Code Dom Err	-54.12 dB rms
CPICH Slot Number	0		(7.5 ksps)
CHANNEL RESULTS			
Symb Rate	15 ksps	Timing Offset	0 Chips
Channel Code	0	Chan Slot Number	0
Chan Pow rel.	0.00 dB	Chan Pow abs.	-11.59 dBm
Error Vector Mag	0.58 % rms	Error Vector Mag	0.86 % Pk

B SGL

Date: 3.JAN.2001 08:24:45

➢ Transfer the measurement results indicated in the channel table to the performance test protocol (read the parameters of all channels by scrolling).

Performance Test Report

Note: *The values specified in the data sheet are guaranteed limits. To these limits, the tolerances of the instruments used in the performance test must be added because of their measurement uncertainty.*

Table 8-2 Performance Test Report

Channel No	Type	Symbol rate	Channel No	Timing offset	Number of pilot-bits	Power (rel.) min value	Power actual value	power (rel.) max value
1	CPICH	15	0	--	--	-0.0		-0.0
2	PCCPCH	15	1	--	--	-0.1		+0.1
3	DPCH	30	2	22016	8	-3.1		-2.9
4	DPCH	30	7	21248	8	-10.1		-9.9
5	DPCH	30	11	34304	8	-3.1		-2.9
6	DPCH	30	13	6400	8	-8.1		-7.9
7	DPCH	30	17	13312	8	-4.1		-3.9
8	DPCH	30	20	26368	8	-4.1		-3.9
9	DPCH	30	23	11520	8	-5.1		-4.9
10	DPCH	30	27	24832	8	-4.1		-3.9
11	DPCH	30	31	36608	8	-7.1		-6.9
12	DPCH	30	35	14336	8	-5.1		-4.9
13	DPCH	30	38	28672	8	-4.1		-3.9
14	DPCH	30	41	26624	8	-9.1		-8.9
15	DPCH	30	47	15104	8	-6.1		-5.9
16	DPCH	30	51	13056	8	-8.1		-7.9
17	DPCH	30	55	5888	8	-8.1		-7.9

Channel No	Type	Symbol rate	Channel No	Timing offset	Number of pilot-bits	Power (rel.) min value	Power actual value	power (rel.) max value
18	DPCH	30	58	6656	8	-7.1		-6.9
19	DPCH	30	62	256	8	-6.1		-5.9
20	DPCH	30	64	35072	8	-12.1		-11.9
21	DPCH	30	69	22528	8	-9.1		-8.9
22	DPCH	30	74	16640	8	-9.1		-8.9
23	DPCH	30	78	7680	8	-7.1		-6.9
24	DPCH	30	82	9472	8	-9.1		-8.9
25	DPCH	30	85	4608	8	-5.1		-4.9
26	DPCH	30	88	32000	8	-6.1		-5.9
27	DPCH	30	94	7680	8	-7.1		-6.9
28	DPCH	30	97	38144	8	-8.1		-7.9
29	DPCH	30	102	15616	8	-12.1		-11.9
30	DPCH	30	108	31488	8	-5.1		-4.9
31	DPCH	30	113	32768	8	-10.1		-9.9
32	DPCH	30	117	21248	8	-7.1		-7.9
33	DPCH	30	119	36608	8	-14.1		-13.9
34	DPCH	30	125	1280	8	-2.1		-1.9

9 Glossary

CPICH	Common pilot channel (spreading code number 0 with spreading factor 128) The channel constantly contains the symbol (1,1) throughout the total length of the WCDMA frame. For the measurements, the CPICH (Primary CPICH) is used for synchronization. For this reason, the CPICH must be contained in the signal to be measured.
Crest factor	Ratio of peak to average value of the signal.
DPCH	Dedicated physical channel, data channel. The data channels which can be sent at different transmission rates are automatically recognized during the measurement.
Inactive Channel Threshold	Minimum power that a single channel must have as compared to the total signal to be recognized as an active channel
Composite EVM	In accordance with the 3GPP specifications, the squared error between the real and imaginary parts of the test signal and an ideal reference signal is determined (EVM referred to the total signal) in a composite EVM measurement.
PCCPCH	Primary common control physical channel (spreading code number 1 with spreading factor 128) The channel is used for synchronizing the measurements. For this reason, it must be contained in the signal to be measured.
Peak Code Domain Error	In accordance with the 3GPP specifications, the error between the test signal and the ideal reference signal is projected onto the classes of the different spreading factors in the case of a peak code domain measurement.
PICH	Paging indication channel This special channel is defined in the test models to 3GPP for measurements on base station signals. Since it does not contain any pilot symbols, it cannot automatically be recognized during the measurement. Therefore this channel must be deactivated for CDP measurements.
SCH	Synchronization channel, divided into P-SCH (Primary Synchronization Channel) and S-SCH (Secondary Synchronization Channel). The two channels are required for synchronizing the measurement. Therefore they must always be contained in the signal to be measured.
Timing offset	Offset between the start of the first slot of a channel and the start of the analyzed WCDMA frame (in multiples of 256 chips).

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